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MARKET FAILURE AND ENERGY POLICY: A RATIONALE FOR SELECTIVE OBSERVATION

by

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Abstract

Appropriate activities for the government in the energy sector of the U. S. economy are suggested on the basis of market failures in this sector. Alleged market failures are explored and specifically targeted remedies proposed where indicated. The resulting government policies can be characterized as selectively conservationist: designed to induce lower levels of use of particular fuels--sometimes in particular industries.

Key words: markets, efficiency, conservation

MARKET FAILURE AND ENERGY POLICY:
A RATIONALE FOR SELECTION CONSERVATION*

1. Introduction

What is the appropriate role of government in allocating energy resources? Some people, including some members of the current (at this writing, the Reagan) administration, appear to believe it is a minimal one. With the exception of a very few areas, such as regulation for nuclear safety, that call for a government presence, they believe that the market can be relied on to allocate energy resources efficiently.** Others, notably those active in organizations that promote energy conservation, favor a much more active interventionist role for government and, as their own activities suggest, to promote conservation.

This paper takes a critical look at both views. It uses economic theory to shed light on the questions of whether, in what circumstances, and in what ways government action is appropriate. The next section sets out some principles, rooted in economic theory, that will be useful in organizing the discussion. Section 3, the heart of the paper, uses the principles to assess the rationale for intervention in specific situations--and, equally important, the nature of the intervention indicated. Main conclusions are restated in section 4 with a view toward implications for conservation.

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**Some members of the current administration support tax incentives for energy supply.

2. Organizing Principles: A Framework for Discussion

The four key words are efficiency, markets, failures, and remedies. Considering each in turn, we arrive at the principles needed to guide an evaluation of competing claims about the appropriate role of government in the energy sector.

First, efficiency: This is the cornerstone of economic analysis. Though often presented in mathematical or diagrammatic form, the concept of efficiency can be conveyed in a simple, common-sense way. In essence, it means doing the best you can with what you have--getting the most out of your endowment of energy (and other) resources. This ordinarily implies a balancing of the benefits and costs of an activity at the margin. For example, efficient production of an energy commodity calls for minimizing the costs at each step of the way and a level of production such that the benefit of the last, or marginal, unit produced is just equal to its cost. We shall use this concept of efficiency as the criterion for energy resource allocation. It seems simple enough, yet it provides a powerful tool for assessing energy policies.

An important distinction to note here is between economic efficiency as just defined and energy efficiency as used by many noneconomists. Energy efficiency, as we understand it, refers to the quantity of energy involved in the production or use of a good and is, therefore, a narrower concept than economic efficiency, which considers tradeoffs with other resources.

Next, markets: One of the oldest ideas in economics, going back at least to Adam Smith, is that competitive markets can be relied on to allocate resources efficiently. Not only is this an old idea, it is a profound one, especially as developed by modern theorists such as recent Nobel Laureate, Gerard Debreu (1959). After all, why should the decentralized decisions about what and how much to produce and consume, by millions of agents in an economy, lead to anything other than chaos? Yet, it turns out that, under certain conditions, an equilibrium set of prices and outputs can be shown to exist. Moreover, the corresponding allocation of resources will be efficient! It is presumably this result that leads some to advocate reliance chiefly on the market, with very little scope for government activity, as a solution to our energy problems.

But remember the qualification: A market allocation will be efficient under certain conditions. When these conditions do not exist, markets can fail. To the extent that markets fail, government intervention may improve the efficiency of the allocation of resources--though it is, of course, not guaranteed to do so. The key questions, which we address in the next section, are what kinds of market failures, if any, are important in energy? And how do they distort the allocation of resources away from an efficient configuration? It is presumably the notion of market failure that spurs political demands for government efforts to promote conservation. But is this the appropriate remedy?

We come then, finally, to remedies. When markets fail and distortions occur, what should be done? The idea we want to put forward--derived from the theoretical work of another Nobel Laureate, Jan Tinbergen, on targets and instruments (Tinbergen, 1952)--is that, to a particular source or type of market failure (target), there corresponds a particular corrective action or remedy (instrument).

3. The Role(s) of Government

When the "energy crisis" of a decade ago forced economists and policymakers to take a hard look at the role of government, there was a sense that energy was special, that the fundamental theorem of welfare economics (market allocation is efficient) might not apply. As we shall see, there <u>are</u> special characteristics of energy markets that can inhibit efficiency. But one source of concern, the nonrenewable nature of energy resources, turns out not to be crucial for policy. The fundamental theorem has been extended. Although the conditions that characterize an efficient allocation <u>are</u> different, it continues to be true that market allocation is efficient. For example, price is not equated simply to marginal production cost. But competitive, profit-maximizing producers will pay attention to the difference, known as the resource royalty, just as a hypothetical planner concerned only with efficiency would.

There is a caveat here. In the now well-known theory, originally developed by Harold Hotelling (1931), the royalty will rise over time at a rate equal to the rate of interest or discount. This assures an equilibrium in which the return on the resource in the ground, viewed as a capital asset, is equated to the return on other assets. Yet, some people, including some economists, have argued that the social rate of discount, the rate that would ideally be used in a social decision, is below the private market rate. This is a deep and complex issue; and discussion, even reference to the vast literature, would take us far afield. What we can say is that, <u>if</u> one accepts the proposition that private market interest rates are "too high," then the market will in general make insufficient provision for the future and in particular deplete nonrenewable resources too quickly. The indicated remedy is a lowering of interest rates throughout the economy. However, since this may conflict with other <u>macro</u> policy objectives, a second-best alternative might be something like a severance tax on resource extraction. Severance taxes are normally imposed at the state level, but the federal government is already involved--pushing, unfortunately, in the opposite direction--via its tax policy on oil depletion. What this suggests, in the circumstances, is elimination of what remains of the federal depletion allowance (it now applies only to small producers). This would at least be a neutral act. If one is sufficiently impressed with the social discount rate argument, then a further step toward a negative depletion allowance--in effect, a severance tax--would be indicated.

Whatever one believes about depletion rates of nonrenewable resources over the long run, claims of more immediate kinds of energy market failures need to be addressed. Our concern will be to indicate not just the source of the alleged market failure but, as in the discussion of depletion rates, the nature of the resulting distortion and a suggested remedy.

Externalities

Probably the market failure that is easiest to understand, and to agree on, is that arising from the presence of what the economist calls externalities, or spillovers [for an early and comprehensive discussion, see Musgrave (1959)]. In the case of energy, two kinds seem particularly important: national security and environmental quality. The national security argument is that each oil importer, by reducing or eliminating his purchase of oil from an insecure foreign source--as, for example, most of OPEC--contributes to national security and to a reduced vulnerability of the American economy to disruptions in oil supply. Yet, each importer, acting alone, has no incentive to adjust his purchases since this departure from a presumably profitable arrangement would impose a cost on him while the benefits would accrue to others almost completely. The object of policy ought to be to bring about a convergence between the individual benefit/cost calculation and the social calculus. If the problem is that imported oil is too attractive to private buyers, then the solution is to make it less attractive by imposing an import fee, or tariff. The fee could be so many dollars per barrel or such-and-such a percentage of the price. William Hogan, a prominent analyst of the role of energy in the U. S. economy, has suggested that a fee, or tariff, in the range of 30 to 40 percent of the price of oil is appropriate (Hogan, 1984, p. 98). Hogan estimates the revenues from such a tariff in the neighborhood of $20 billion annually, a significant consideration in a time of $150 billion federal budget deficits. Even at the dramatically lower current world oil price--about $15 per barrel, down from $30 per barrel at the time of Hogan's proposal--revenues could be quite comparable, depending on the nature of the tariff. Most taxes distort resource allocation, an effect that has to be balanced against the revenues they produce. The oil import fee would instead improve resource allocation at the same time it brought in needed revenues.

We should note a couple of difficulties with an import fee. First, it could run afoul of international agreements on lowering trade barriers, such as the recent U. S./Canada free trade agreement. Second, it would raise the costs of domestic (U. S.) manufacturers, making them less competitive in world markets. A sensible alternative could be a gasoline tax. This would accomplish much of the desired oil demand reduction without discriminating against foreign oil producers or domestic manufacturers.

The other major energy externality is the impact of energy production and use on environmental quality. Most air pollution, for example, is energy related: 79 percent of carbon monoxides, 43 percent of hydrocarbons, and 51 percent of nitrogen oxides from transportation; and 80 percent of sulfur oxides, 33 percent of particulates, and 44 percent of nitrogen oxides from power generation (Fisher and Smith, 1982, p. 2). Other impacts are well documented. Again, the source of the problem is a divergence between private and social interest. Each polluter, by reducing his emissions, would contribute to a cleaner environment. Yet each, acting alone, has no incentive to do so. Reducing emissions is costly, and the benefits go mainly to others. To harmonize the private and social decision calculus, the government needs to impose the costs of pollution damage on the polluters to be balanced against the costs of control. Two attractive schemes have been suggested. One is simply an emissions tax, of so many dollars per ton of pollutant emitted, with the tax ideally bearing some relation to the damage. The other is creation of a market in emission rights, or permits. That is, the appropriate authority, perhaps a regional office of the U. S. Environmental Protection Agency (EPA) or a state agency, would determine an allowable level of emissions of a pollutant in an air basin or watershed and then auction off the indicated number of permits. Both EPA and some of the states appear to be moving in this direction: EPA with the offset system for air pollution; and the state of Wisconsin, for example, with transferable discharge permits for water pollution.

The earliest, and still the dominant, form of regulation for environmental quality is the "command and control" type in which the regulatory authority mandates the use of a particular control technology or level of performance. What we are suggesting--along with other economists who have studied pollution problems--is movement to a more market-like system to capture the efficiencies of market allocation. The advantages can be substantial. A recent review of empirical and simulation studies of comparative costs of air pollution control finds that command-and-control costs range from about 2 times all the way up to 22 times the least cost for achieving a given degree of control (Tietenberg, 1984, Table 1). The market-like mechanisms we are suggesting tend to the least-cost level. And, like the oil import fee, they would produce revenue at the same time they improve resource allocation.

In addition to being costly, command-and-control-type regulations that do not prohibit all pollution leave remaining externalities. For example, suppose that regulations require a major capital investment in scrubbers for certain coal-fired power plants and that these scrubbers remove part of the pollution from burning the coal. The owners of the plants have no incentive to reduce the remaining pollution. They still do not bear its costs. Since they do not, they have an incentive to burn coal when overall efficiency would be better served by some other choice. Hence, there are some remaining positive benefits to any government action that reduces power plant coal consumption.

Increasing Returns

We have said that external or spillover effects are probably the easiest to understand and agree on in energy markets. A couple of qualifications are in order. First, though we are aware of little dispute about the effects, we must acknowledge serious differences about how to deal with them. Second, another source of market failure may be equally familiar: increasing returns in the transmission, the distribution, and perhaps the production of electric power.

Increasing returns, or decreasing costs, due to economies of scale, make these activities "natural" monopolies--hence, natural candidates for regulation. The difficulty is that the conventional kind of regulation sets price in relation to the average cost of existing facilities to achieve a target rate of return for the utility. Yet, we are now in an era of replacement or marginal costs substantially above the costs of existing capacity. As far back as 1975, the marginal cost of new electricity generation was around 3.5 cents per kwh, whereas the average price of electricity sold to ultimate consumers was 2.7 cents per kwh--a discrepancy of about 30 percent (Sweeney, 1977, p. 192). The discrepancy was (and is) even greater where there exists substantial low-cost capacity not suited to further development as in the case of hydropower in the Pacific Northwest. The result is overconsumption of electric power. The remedy typically suggested by economists is marginal-cost pricing coupled with a tax on the utility, or a rebate system, to skim off the excess profits (above the target rate of return) that would result. If all electricity users used roughly the same amount of electricity, then increasing block rates (i.e., higher marginal rates with higher usage) could achieve the same results. However, with widely varying usage levels, some customers will pay too much at the margin while others will pay too little.

Other Market Failures

We come now to a hazier area. Virtually all economists would agree that markets for environmental quality and national security do not exist and that a role for government is indicated. Most, we feel, would agree with the market-like mechanisms we have suggested to remedy the misallocation that results. Most would probably also agree with the judgement that electricity prices based on historical average costs are on the low side and that some form of marginal-cost pricing ought to be employed. These consensus remedies would correct many of the distortions in energy markets.

But we want to discuss a few additional market failures, or partial failures, and corresponding remedies that may be more controversial. First, there is the area of new energy technologies, including synfuels. It is sometimes alleged that, because of the heavy capital requirements or the great uncertainty involved in bringing a new technology to market, the government needs to step in and do the job. While there may be marginally worthwhile projects that are too big for any firm, high capital costs and uncertain outcomes are not normally evidence of market failure. Thus, there is seldom any reason for multibillion dollar subsidies to new technologies to guarantee their commercial success and almost never any urgency for doing so. On the other hand, the information produced by research into the new technologies does have a substantial element of publicness. That is, some of the benefit will spill over to those not undertaking the research. This is especially true of more fundamental research as opposed to development activity directed at patentable process improvements. For this reason, government expenditure on fundamental energy research is warranted. But it ought to be widely dispersed among competing alternative supply and conservation technologies, not targeted to just a few large development projects. The original synfuels program, for example, with its $88 billion for subsidies to a few commercial ventures, was ill-conceived according to this view of the world. A much more modest program, supporting more basic research into a wider variety of alternatives, however, would be appropriate.

If one believed that an OPEC cartel with great power is likely to push oil prices higher and higher unless it is broken, that U. S. synfuels production is the best way to break it, and that if it is broken the oil price will fall to a level that makes synfuel production unprofitable, then a laissez-faire synfuels policy could not be counted upon to break the cartel and a major government program might have justification. However, even if these premises were plausible in 1980 with conventional crude oil at $30 per barrel and rising, they are clearly implausible at this writing with crude at $15 per barrel.

Market imperfections may also lead to an appropriate role for government support of more applied research. Two reasons may exist for such research. First, the industry that would use such research may be so fragmented that no one firm can justify the applied research, and the costs of assembling a coalition to pay for the research either in advance or afterwards, in the event of a patentable success, may be prohibitive. This is less of a problem with respect to energy supply, where projects are typically large and a substantial portion of the total national effort is undertaken by a few firms, than it is on the energy demand side. In particular, significant parts of the buildings industry are local and fragmented, and a government role in applied research on energy efficiency in that industry is appropriate.

Another, and somewhat related, motivation for government support of applied research is uncorrected "downstream" market failures. For example, due to "landlord/tenant" market failure problems discussed below--or more comprehensively "supplier/builder/landlord/tenant" market failure problems--the manufacturer of building equipment may have little incentive to support research on energy efficiency improvements. Government support of such applied research is justified. Relatively small amounts of federal support have produced dramatic and economically important breakthroughs in the energy efficiency of lighting, windows, and residential heat pumps (American Council for an Energy Efficient Economy, 1986).

It is worth noting that, in the presence of market failure, government support of some energy efficiency research may be justified solely by the reduced cost of consumption of energy by government itself--directly and indirectly through welfare payments based, in part, on the cost of energy.

Although we believe capital markets work quite well for energy producers, once a technology is perceived to be at least potentially profitable, we have some sympathy for the allegation that capital markets work less well for residential consumers. Specifically, it is alleged that, even where it has been demonstrated that the savings from energy conservation substantially exceed the capital costs, some (presumably low-income) consumers will be unable to borrow to finance the investment, for example, in building insulation. This partial market failure is one of the justifications for the low- or zero-interest loan programs for weatherization currently mandated by some state public utility commissions, though the logic of the failure suggests a narrower focus on low-income recipients might be preferable to the near-universal focus of current programs. However, the programs are also motivated by the discrepancy between average and marginal electricity prices and other market failures to be discussed below. Note the distinction between a subsidy for capital-intensive conservation to remedy a partial failure in the capital market and a subsidy for energy consumption, such as lower oil prices for some consumers. The latter has nothing to do with efficiency, or market failure, and indeed would further distort consumption patterns.

Another kind of market failure that has been suggested as distorting consumption patterns is the landlord/tenant problem. The nature of the problem is that neither the landlord nor the tenant, in rental housing, has an incentive to conserve energy even where the benefits of conservation can be shown to exceed the costs. For the tenant, investment in conservation does not pay, as without tenure in the property he cannot count on reaping the benefits. The difficulty is compounded if apartments are not individually metered and billed; the benefits go to the landlord. For the landlord, the problem is that the saving in fuel bills he expects from an investment in conservation can be frittered away by the energy-using practices of tenants--turning up the thermostat, opening the windows, and so on.

If units are metered and the landlord makes an investment (say, in wall and attic insulation), he may hope to get a return in the form of higher rents. That is, units can be advertised as "energy efficient," carrying low monthly energy costs (to the tenant), with correspondingly higher rents. In principle, this is no different from a higher rent corresponding to some other desirable characteristic of a dwelling unit, such as proximity to public transportation or a good view. However, there are costs to individual metering, and it may be difficult for the landlord to collect the full amount of the energy savings in higher rents since the effectiveness of insulation is hard to demonstrate to prospective tenants.

If these problems are too great, utilities might be required to subsidize the conservation investment cost and allowed to recover this cost in the rate base. If it is, indeed, true that conservation is cheaper than investment in new generation capacity, the ratepayers will benefit. Of course, the energy-consuming behavior of unmetered tenants can inhibit the effectiveness of this solution and, hence, individual metering should also be considered. However, the problem is complicated by the fact that heat loss from one apartment into another is an externality. The size of this effect is a difficult technical matter.

One of the assumptions of the neoclassical welfare economics of Debreu is that there is no cost to an economic agent marshalling the available information to make the decision that maximizes his own position. While never literally true, this is often an unimportant assumption, especially for large transactions. However, it can be quite far off when individual transactions are small. One way to think about this situation is the concept of "satisficing" decision making suggested by Herbert Simon, yet another Nobel Laureate (Simon, 1955). A satisficing decision is one that stops (costly) search for the best solution once a good one is found. An alternative way of thinking about the situation is to assume that information is asymmetrically available. When consumers who satisfice in small isolated transactions or who have inferior information buy from well-informed suppliers, systematic distortions can result. For example, if it is difficult for consumers to discover reliably the energy cost of operating an electric water heater but easy to discover the price, consumers may tend to ignore energy efficiency and choose less expensive water heaters. This, in turn, will give water heater manufacturers an incentive to leave out cost-effective insulation from the water heaters they manufacture so as to hold down the price. This is not a hypothetical example. There is convincing evidence of failure of the free market to achieve the economic level of energy efficiency for several major energy-consuming appliances (Ruderman et al., 1984).

This kind of market failure provides incentives for several different kinds of government intervention. The first of these is labeling. If a public agency could make accurate, credible, and easy-to-use information available to consumers at the point of purchase decision, this could clearly help and might prove to be a cost-effective program. Appliance energy labels and automobile mileage labels are current examples.

A second government intervention that might prove cost-effective is minimum efficiency standards. Labels may not be effective if they are hard to understand and interpret, if they are not credible, if their presence is hard to enforce, or if market failures other than information failure (e.g., the landlord/tenant problem) are present. If the government could set minimum efficiency standards so low that only those appliances so inefficient that no one could rationally buy them were forbidden, then, except for enforcement costs, the economic effect of the standards would be all gain. Setting mandatory standards at a higher level involves a trade-off in which some consumers are disadvantaged (e.g., the purchasers of an air conditioner for a seldom-used mountain cabin) while others are helped. The economic efficiency effects of a mandatory standard would be greatest if the marginal benefit to consumers rationally preferring more efficient appliances just equals the marginal harm done to those who would rationally prefer less efficient appliances. However, if there is significant variation in the rational energy efficiency level, economic efficiency can be improved by making the standard variable. This can be done best if the standard can be tied to a major cause of the variability--e.g., climate and local energy costs for insulation or air conditioners. However, even when this cannot be done effectively, standards can be made flexible by applying them only to the average of a manufacturer's output or by allowing their violation at a price.

4. Conclusions and Implications for Conservation

Let us restate briefly the market failures and suggested remedies we have identified. It will be convenient to do this in the form of a table as in Table 1 below. The entries should be self-explanatory and need no further discussion here.

There is one aspect of the distortions that does merit discussion, given our earlier focus on conservation. Each, with the possible exception of the impact on environmental quality, results in too much energy being consumed. And in each case, the remedy calls for the consumption of less energy. Thus, though we did not start out by assuming that "conservation" is the solution to our energy problems and, indeed, have tried to tailor remedies (instruments) to particular distortions (targets), the net result appears to be something like conservation. This is probably true in the pollution case as well since the higher energy product prices that would result from higher control costs would tend to reduce consumption of the products. Note, however, that what we emerge with is a kind of selective conservation. For example, the effect of

TABLE 1

Energy Market Failures and Suggested Remedies

	MARKET FAILURE	DISTORTION	PREFERRED REMEDY	OTHER REMEDIES
NATIONAL SECURITY	Inadequate incentive to individual importer to restrict oil imports	Too much oil imported	Oil import fee	Gasoline tax
ENVIRONMENTAL QUALITY	No incentive to protect environment	Too much pollution	Emission charge or creation of market for emission rights	Fuel use reduction activities
INCREASING RETURNS	Natural monopoly	Current price regulation based on average costs leads to overconsumption of electricity	Marginal or replacement cost pricing, with excess profits tax	
NEW TECHNOLOGY	Spillovers from research, downstream market failures	Too little research and development of new energy sources and technologies	Subsidy to basic research on a wide variety of projects and applied research in impacted areas	
RESIDENTIAL CONSERVATION	Inability of low-income consumers to finance	Too little conservation	Zero-interest loans targeted to low-income consumers	
LANDLORD/ TENANT	Inadequate incentives for either party to conserve	Too little conservation	Individual unit metering and conservation program subsidized by utilities and recovered in rate base	
NONRENEWABLE RESOURCES	Private market discount rate too high	Too rapid depletion of nonrenewable resources	Elimination of depletion allowance, possible imposition of severance tax	Resource use reduction activities
TRANSACTION COSTS	Inadequate or hard-to-use information on energy efficiency	Too inefficient energy-using capital	Effective labels	Standards

the oil import fee would be to reduce consumption of oil, expecially imported oil. Consumption of other energy sources could rise. Similarly, higher prices for electricity would reduce consumption of electricity with mixed effects on primary sources like coal, oil, and gas. Subsidies to new technologies would presumably result in greater consumption of their products, down the road, though balanced by reduced consumption of conventional fuels as these are depleted and their prices rise. The building energy-conservation subsidies would seem to unambiguously reduce fuel consumption with no obvious offset. The same is true of labels and standards for appliance energy efficiency.

It is worth noting that we have concentrated on preferred remedies. These are preferred for their economic characteristics. However, in some cases they may be impractical for political or other reasons. When such preferred remedies are not undertaken, they leave a distortion that provides incentives for other measures. For example, economic efficiency would be served by an oil import tax and the end to preferential tax treatment of oil production. However, in the absence of these remedies, taxes on petroleum products can have positive effects on efficiency.

The point we wish to make, in closing, is that we have focused on energy market failures and appropriately targeted remedies. Any impact on overall energy use has been incidental. The result, indeed, is likely to be less energy use per dollar of gross national product, or even per capita, if our recommendations are carried out. But this is just the result of letting the energy chips fall where they may in pursuit of the broader goal of economic efficiency.

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