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Author
Blumstein, C.

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Lawrence Berkeley Laboratory
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Carl Blumstein, Betsy Krieg, Lee Schipper and Carl York

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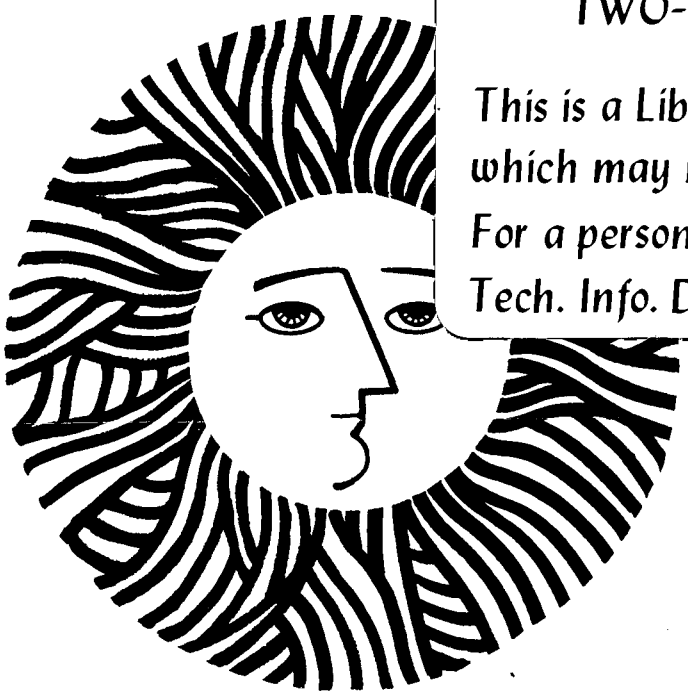

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Overcoming Social and Institutional Barriers to Energy Conservation*

Carl Blumstein
Betsy Krieg
Lee Schipper
Carl York, Principal Investigator

Energy & Environment Division
Lawrence Berkeley Laboratory
Berkeley, California 94720

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ABSTRACT

Energy conservation actions can be economically rational responses to the energy crisis. But these actions may be hindered by social and institutional barriers. The nature of these barriers is explored and a taxonomy of barriers is proposed. Results of a series of interviews providing examples of the different types of barriers are reported. Strategies for overcoming barriers are examined and some criteria for evaluating such strategies are developed. The importance of considering not only the efficiency of strategies in achieving the goal of energy conservation, but also their impacts on others, possibly competing, social and economic goals is emphasized. The need for both increased efforts aimed at overcoming barriers and further research into the nature of barriers and further research into the nature of barriers is discussed.

I. INTRODUCTION

The winter of 1973-74 was the winter of the energy crisis. Long lines at the gasoline stations brought home the fact that resources upon which we had become dependent were both limited and largely under the control of foreign interests. Five years have elapsed since the Arab embargo, and while the sense of crisis receded for a time, recent events in Iran and Pennsylvania have served to remind us again that the problem has not gone away. Domestic production of oil is continuing to fall behind consumption, financial and environmental costs of obtaining new supplies are increasing, and our vulnerability to the actions of foreign suppliers is growing.

The nation's response to this multi-faceted problem has been fitful and uncertain. Initially, attention was focused mainly upon the supply of energy; massive schemes were propounded to increase the domestic production of fuels so that independence from foreign suppliers could be achieved by 1985. But, even in the early days of the energy crisis some analysts were insisting that efforts should also be made to moderate the demand for energy by the adoption of conservation measures. Now, the plans for early energy independence seem naive and energy conservation has assumed a much greater importance. Indeed, the President has established conservation as the "cornerstone" of the national energy policy.

Unfortunately, the word "conservation" has become brittle with misuse. It has come to mean "sacrifice," "lowering of living standards," "slowing of economic growth," or "limiting freedom of choice." Is the cornerstone of our energy policy a kind of national self-denial? We think not. Conservation can be a rational response by resource users to changes in conditions of supply, price or social cost. There is a compelling case that many energy conserving actions will, in fact, tend to maximize well-being and minimize sacrifice and social cost.*

If conservation actions are rational economic responses to the energy crisis, then why shouldn't the nation simply wait for market forces to cause these responses? There are some encouraging indications that these forces are indeed bringing about conservation responses. But, a "hands-off" strategy may not be sufficient. Additional policies must be considered because energy prices are now

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*For example, Schipper, L. and J. Darmstadter, "The Logic of Energy Conservation," Technology Review, 79, pp. 41-50 (1978).

substantially below the total costs, including social costs, of energy use; the market cannot be expected to produce the socially optimal conservation response under these circumstances. To a large extent, today's energy pricing problems are consequences of past government policies. But finding effective and equitable ways of undoing old policies is often more difficult than initiating new programs.

As those who have followed the evolution of the nation's energy policy are well aware, the issue of energy pricing has stirred a great deal of controversy. This controversy has to some extent diverted attention from the fact that, even when prices are "correct," there are reasons why the market may fail to produce the optimal conservation response. A number of barriers that may hinder or block the market from achieving a satisfactory outcome are embedded in our social norms and institutional arrangements. In what follows, we examine these barriers and some of their consequences for energy policy.

Although barriers to energy conservation are not an altogether new topic for policy analysts,* previous workers have devoted very little effort to systematic study of the problem. Therefore, we have begun with an effort to define and classify carefully the various types of social and institutional barriers to energy conservation. Then, by way of illustration, we report the results of a series of interviews. The interviewees are all persons who have some connection with energy consumption in buildings; their comments do not provide a basis for any broad generalizations, but they do give some concrete examples of barriers in one of the major energy consuming sectors. Next, we discuss some of the strategies that might be employed to overcome barriers. In this discussion we give some attention to the development of criteria for evaluating strategies. Finally, we give some concluding remarks and some recommendations for action.

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*For example, Krieg, B., Bibliography on Institutional Barriers to Energy Conservation, LBL-7885. Berkeley, California: Lawrence Berkeley Laboratory, 1978.

II. THE NATURE OF BARRIERS

We are concerned primarily with barriers that prevent the adoption of cost-effective energy conservation measures. First, we need to examine the reasons why such measures do not always happen as the automatic result of market forces. Six classes of barriers that occur rather regularly can be identified:

- Misplaced Incentives. The economic benefits of energy conservation do not always accrue to the person who is trying to conserve. For example, if a tenant in a rental dwelling pays the utility bill, then the landlord has little incentive to be frugal in his use of energy. A more subtle example is the manufacturer who is reluctant to undertake research on energy conserving products because his competitors may benefit from the information that is obtained without bearing the cost of getting it.
- Lack of Information (or Misinformation). The efficient working of the market depends on the parties to transactions having adequate information. If a consumer is unaware of the cost effectiveness of a conservation measure, he will probably not undertake it. If architects do not know the principles of energy-efficient design, efficient buldings will probably not be built. Information problems range from mundane questions such as how to find a reliable insulation installer to very complex topics such as the optimum design for a house.
- Regulation. If a cost-effective measure conflicts with codes or standards, its implementation will be difficult or impossible. Regulatory barriers are often evidence of conflicting social goals. For example, environmental standards may conflict with new cogeneration facilities at existing industrial sites if these sites are in "non-attainment" air quality regions. Other regulations are protected by powerful special interests; for example, certain regulations requiring empty backhauls (that is, return trips without cargo) in the trucking industry.
- Market Structure. Even though a conservation measure or device is cost effective, it may not be on the market. All firms have some stake in the status quo: production equipment, trained personnel, established markets, etc. In highly concentrated industries, where market share is often determined as much by the strengths of the marketing organization as by the quality of the product, the risks of introducing significant product changes may outweigh the

likely benefits. Small firms trying to introduce new products may find themselves undercut by powerful marketing organizations who can "bad-mouth" a new product and make access to wholesale and retail outlets difficult.

- Financing. Energy conservation measures often require an initial investment; thus, the availability of capital may be necessary for some measures. In principle, the market will allocate capital so that the best investments are financed. But capital markets are not perfect; risks may be overestimated or benefits underestimated and transaction costs may be high. These factors may make it difficult to obtain financing for some cost-effective conservation measures.
- Custom. If a cost-effective conservation measure requires some alteration in the habits of the consumer or seems contrary to some accepted value (for example, is perceived as something that only people of low social status do), then it may be rejected. Custom may be related to lifestyle preferences. However, some customs ("this is the way we have always done it") don't seem to have any connection with a particular lifestyle, while with others (driving an expensive big car instead of an expensive small car), the connection is ambiguous.

Often, barriers encountered in practice do not fit neatly into one of the above classes, but rather have elements from several classes. Consider, for example, some of the reasons why owners who expect to move in a short time do not always bring their buildings to the optimum level of energy efficiency. At first glance, this is a problem of misplaced incentives; the owners do not think they can recover the costs of energy improvements when they sell their buildings. But, since the improvements are cost-effective, buyers ought to be willing to pay for increased energy efficiency. One reason why they do not may be lack of information. Two kinds of information problems must be considered. First, the buyer may not know that the conservation measures are cost effective. Second, the buyer may not be able to determine that the conservation measures are actually in place (for example, wall insulation) and have been installed properly. Even if the buyer is fully informed, he may not be able to pay the added initial cost of energy efficiency. If mortgage loan institutions do not consider the effect of utility bills in determining the buyer's ability to repay his loan, then the buyer may not be able to qualify for a larger loan, even though his ability to repay is enhanced. This financing failure might in turn be attributed to the fact that mortgage loan institutions lack information about the effects of energy efficiency on their clients' credit worthiness.

If we want to develop strategies for overcoming barriers, our analysis of the nature of barriers must go beyond their classification to explore their causes. Doing this sometimes requires that we unravel a tangled causal chain. But, as an example will show, the effort can provide considerable guidance in choosing effective strategies.

Commercial building operators (the people who control the air conditioners, maintain the lighting systems, etc.) have a large influence on building energy consumption. A competent operator can often reduce consumption by 30 percent through the use of such measures as proper scheduling of equipment use, preventive maintenance, control of lighting, and other housekeeping measures. But many building operators are not competent; they do not know how to maintain their equipment for maximum efficiency, they do not know the proper lighting levels, and they do not know the most efficient operating schedules. There is, in short, a lack-of-information barrier. This barrier may be attributed to poor training, but an examination of the operator's job suggests that the cause of the problem may lie elsewhere. The performance of a building operator is generally judged on how well he keeps things working and not on the energy bill for his building. If he changes operating procedures in order to conserve energy, he is likely to generate some complaints from the building's occupants that will reflect adversely on the building owner's view of his job performance. This is essentially a misplaced-incentives barrier. Unless the building owner (the main beneficiary of conservation) expects the operator to improve energy efficiency and rewards him for it, there is little reason for the operator to learn about energy conservation.

The reason that owners do not have higher expectations of building operators is probably that owners lack information on the potential cost savings from conservation. From the point of view of the policy maker who attempts to find ways of overcoming barriers, this is a weak link in the causal chain. That is, intervention aimed at increasing the information of building owners will ameliorate the problems upward in the chain (i.e., misplaced incentives, untrained operators), but the links below (i.e., the causes of uninformed owners) will not create opposition to this strategy. (In this example, we have ignored the effects of rental and property management agreements; these can make things more complicated, as seen in the Case Studies section below.)

Of course, following the causal chain does not always reveal a weak link. Many barriers are rooted in deep-seated conflicts of interest. Labor unions protect obsolete building codes that provide jobs for their members. Energy companies promote production as opposed to conservation because they profit from it. Manufacturers block innovations because innovations increase competition.

The policy maker needs to make some assessment of the strength of a barrier before he develops strategies for overcoming it. Part of this assessment is political--an evaluation of the political resources of the defenders and opponents of the barriers. This is necessary in order to decide whether some strategy will meet so much opposition that it will be impossible to implement.

Political assessment deals for the most part with short-run considerations, but the success of strategies will also depend on longer-run social and institutional considerations. In the long run view, barriers can be classified as either stable or transient.

Transient barriers are caused by a kind of societal inertia; they delay adjustment to new conditions. (We are concerned especially with adjustment to higher energy prices.) Transient barriers may be tenacious, but when broken down, they stay down. Examples are obsolete information, regulations that are no longer appropriate, and "old-fashioned" habits. For the most part, one expects that transient barriers will eventually be overcome by the normal workings of the market. Government intervention to remove transient barriers may be justified when the effects of market forces are slow and the costs of delay are high.

Stable barriers are more deeply embedded in the social and institutional fabric. They are not only tenacious but also resilient; when broken down, they tend to reappear in altered form. The landlord-tenant relationship provides an example. As we have noted, when the landlord pays the utility bill, the tenant is likely to be profligate in his energy use. But when responsibility for the bill is shifted to the tenant, the landlord loses much of his incentive to make energy conservation improvements. Market forces may have some impact on this stable barrier, but the essential conflict of interest between landlords and tenants is not altered by these forces. One might expect, for example, that rising energy costs will cause tenants to be willing to pay more for energy-efficient apartments, thus providing some incentive for landlords to make conservation improvements. However, there is a formidable information barrier to

this correction because it is difficult to determine the energy efficiency of an apartment, and owners of inefficient units are unlikely to provide much assistance to the "efficiency shopper." As a practical matter, energy prices will have to go a good deal higher before efficiency shopping becomes much of a factor in the rental housing market.

The desired outcome in the housing market is that landlords bring their property to the optimal level of energy efficiency and that landlords and tenants share the savings equitably. This outcome would be the result in a perfect market. But here, the perfect market requires that tenants be energy conservation specialists and that landlords be candid. Government intervention in this situation might be justified if some set of rules could be devised for landlord-tenant transactions that would bring their result closer to the desired outcome without such stringent requirements for expertise and candor.

Thus far we have treated human behavior as if it were motivated entirely by economic self-interest. While selfish economic motives are responsible for much of human conduct, they surely are not sufficient to explain all behavior. Ethics and social norms, among other factors, may be very influential. In order to develop strategies for overcoming barriers to conservation, we need to understand what role these factors play.

One consequence of affluence is that we do not always have to worry about making economically efficient decisions. If energy costs represent only a small part of our total expenses, as is true for most Americans, what does it matter if we waste a little? We can afford it. Many observers of the American scene have noticed this kind of behavior; the phrase "conspicuous consumption" has been widely used in describing it. If one wishes to take a purely economic view of behavior, then one might say that there is a value to waste. That is, we find it gratifying to be indifferent to cost, and the amount we waste is a measure of the value we assign to this gratification. While this view preserves the economic model of behavior, it does not alter the fact that the roots of conspicuous consumption are psychological and normative. While these motives are not a concern for economists ("Economics speaks not of preferences"), they must be addressed by policy makers. Certainly, one way to advance energy conservation is to remove energy from the list of goods for which conspicuous consumption is socially acceptable. This would not necessarily imply lifestyle changes, but require that we pay more attention to efficiency. That is, it would add a moral imperative to the selfish motives for economic efficiency.

Ethics and social norms also play a role in technical innovation. Solar energy provides a striking example of this. Many, if not most, residential solar energy installations in place today are, at best, marginally cost-effective. But the owners of these systems were motivated by other concerns: they wanted to contribute to social goals or to have a system to experiment with or just to be different. Whatever the motivation, this pioneering behavior has considerable value for society. Without it, much of the impetus for private enterprise to develop solar technology would be lost. Moreover, the experience gained by practical applications in "real world" situations is crucial to the establishment of a viable industry. Of course, the pioneering spirit has long been identified with the American character, and it has often been channeled by society, more or less consciously, to further social goals.

Whether it is the pioneering spirit or just cost consciousness that we wish to see directed toward energy efficiency, we might well view the absence of a strong "conservation ethic" as a barrier to conservation. It is possible for government intervention to encourage the development of such an ethic. In fact, government action to reinforce values thought to be socially desirable (e.g., charity and patriotism) is quite common. On the other hand, government attempts to alter social values can pose a threat to the individual's freedom of thought. Still, in an age when commercial interests spend billions to persuade us to consume and to manipulate our values for private gain, it is appropriate to consider ways in which the government can use persuasion in the collective interest.

III. CASE STUDIES

This section reports the results of a series of case studies (interviews of up to two hours) that were conducted to gain some insight into barriers to conservation in the buildings sector. The taxonomy of barriers outlined in the preceding section is, we think, a useful guide for reading this interview material. However, the material is not presented to prove the adequacy of the taxonomy; interviewees were selected somewhat haphazardly and may not be "typical." Rather, we hope to leaven the abstractions of our analysis with some real-life experience. Thus, the case studies are presented in an informal way to allow the feeling and flavor of the interviews to emerge along with the facts about what some people are doing (or not doing) about energy conservation.

The case studies have been divided into three groups: with landlords and managers of residential property; with managers, owners, and operators of commercial property; and with some of the other people involved in the buildings sector, such as realtors, representatives of trade associations, and contractors.

A. Interviews with Landlords and Managers of Residential Property

Case 1: T.E., A Small Landlord

T.E., a middle-level executive with a strong interest in energy conservation, owns at least two apartment houses of the "old-Berkeley-house-converted-into-apartments" variety. One is master-metered and and one is individually-metered.

T.E. has considered several energy conservation measures for the master-metered apartments, including roof insulation, water heater insulation, weatherstripping, energy conserving appliances and fluorescent lights in the kitchen. He has installed roof insulation and purchased insulation for wrapping the water heater, although he has yet to install it. T.E. feels weatherstripping is not cost-effective in older buildings in Berkeley because the buildings shift seasonally on their foundations as the ground expands and contracts in response to weather conditions.

Energy-conserving appliances, specifically refrigerators, are not available in small, apartment-size units. T.E. has also found that appliances in the older buildings tend to be more efficient (66 percent efficient motors) and better insulated (6" versus 1" to 4" refrigerator walls) than currently available energy-conserving units. He is considering replacing kitchen and adjoining eating area lights with fluorescent tubes.

T.E. identified several problems in trying to get landlords, including himself, to make energy-conserving improvements. The problems include:

(1) the lack of easily available, inexpensive skilled labor;

(2) the inherent landlord-tenant conflict; and

(3) the cost of energy conserving measures.

T.E. also had several suggestions on how to resolve or at least mitigate the adverse effects of these problems. He suggested using federal grant money to train individuals to install insulation, etc. The CETA program was suggested as a source of money and people. The idea would be that after a brief training period, six months or so, CETA trainees would be able to set up their own businesses. Even if no new businesses were started, the program would provide a pool of unskilled or semi-skilled workers on which landlords could draw. Unemployment would drop, energy conservation would increase, and landlords would have a source of cheap, skilled labor.

The inherent landlord-tenant conflict can't be eliminated in the course of doing energy conservation, but the conflict can be intensified or reduced. T.E. objects to a proposed Berkeley point-of-sale insulation ordinance because, as he sees it, it creates more conflict between landlord and tenants. He would like to see equal protection for the landlords incorporated in any regulations. For example, if weatherstripping were required, an inspection could be made when a tenant moved out to determine if it needed to be replaced, and whether the landlord or tenant should pay for the repairs.

Regarding the cost of conservation measures, T.E. indicated he was willing to invest in measures with a three to five year payback as he expected to own the apartment for 15 to 20 years. Other landlords might need shorter payback periods if they expected to sell the apartments sooner.

T.E. feels strongly that the best way to implement energy conservation is through regulations that are well considered and that allow time for the measures to be implemented.

T.E.'s comments seem to focus on the problem of the misplaced incentives as a barrier to energy conservation. He has access to much information on energy conservation and does not see existing regulations as hindering him in his efforts except perhaps through the need to use high-priced union labor, which he can ill afford. "Market structure" might be the reason small energy-efficient refrigerators are not available, but more work is

to verify this. Neither financing nor custom appear to be important barriers. But, from T.E.'s standpoint, the return on the energy-saving investments is not terribly high in dollar terms, the investments require considerable time and effort (the transaction costs are high), and while he must bear these costs, he cannot always be sure of securing the benefits.

T.E. is exceptional in his knowledge of energy conservation, but others who are not so knowledgeable are nevertheless concerned.

Case 2: C.B., Another Small Landlord

C.B. is a landlord who owns a triplex and a small cottage at the rear of her own house. She has made no energy conservation improvements to the cottage. The triplex is heated by hot water pipes in the floor, and the electricity is master-metered. The tenants pay their own water bills.

C.B. has considered roof insulation, re-metering, and water heater insulations as ways to reduce energy consumption. The triplex has beamed ceilings, which makes roof insulation impractical at the present time. C.B. is considering installing ceiling tiles, which would preserve the beamed look while also providing insulation. However, she still does not know the material and installation costs of such a project.

Re-metering has been considered, but here, too, the costs are unknown to C.B., as is the procedure necessary to get the work done. Does the utility provide the meters and the work crew, or must an electrical contractor be found, etc.? Also, C.B. is reluctant to ask a tenant who has lived in the triplex eight years to pay her own utility bill.

Insulating the hot water heaters seemed the most feasible energy conservation measure, and C.B. expects to wrap the heaters in the near future. She knows the initial cost is low and the savings good. She has been unable to locate one of the Johns Manville "do-it-yourself" kits and has not actively pursued the idea recently.

C.B. has also considered energy conserving appliances, but found that replacing her own refrigerator with an efficient Amana would cost an extra couple hundred dollars. She was not willing to pay that much more. The choice of energy efficient, non-frost-free refrigerators is quite limited in C.B.'s experience. (She likes this kind of refrigerator best because she contends they keep food better and the ice cubes don't evaporate.) She uses long-lived bulbs in all of the apartments and outside areas. She was not aware that these bulbs usually give a lower light output per watt.

C.B. sees her major problem as one of landlord-tenant relations. For example, there is no mechanism for getting tenants to turn down the temperature of their water heaters, and for the sake of super-hot water, all the heaters are left on "high". She pays the gas bill and doesn't benefit from the extra hotness.

C.B. needs a fairly short payback period, on the order of two or three years at the outside, which somewhat limits her options.

Beyond their concern for the financial aspects of energy conservation, both of the above interviewees appeared to have some commitment to conservation as a social good. Still, only one of them has made significant conservation improvements. Other less committed landlords would probably make even less headway.

Case 3: A.S., A Management Company Executive

A.S. works for a management company that handles about 1500 apartments in the East Bay. The apartment owners are a diverse group, ranging from individuals to syndicates with five to 20 partners. All costs are passed through either to the tenants or owners.

A.S. forsees no changes in the company's position on energy conservation, which can be characterized as "energy conservation is a good thing, but we're not convinced it's cost effective in the real world." He had several suggestions on possible ways to overcome this cost effectiveness/information barrier, however.

First, A.S. feels that PG&E's conservation inserts in the monthly utility bill are a potential source of conservation information, but they are not too effective. He feels more people would read them if the inserts came every two months or so, rather than as a routine monthly bill stuffer. In addition, he says he never sees the inserts because his wife pays the bills.

Second, his company could use plots of past usage, say the last six months compared to the same period a year ago. The company does not have the personnel to do this in-house, but would be very receptive to PG&E providing this service. One idea would be to have PG&E provide such information quarterly to all commercial property owners, for a fee. A.S. sees this as one way to provide hard data to owners. Such a data base is necessary before owners can be persuaded that energy conservation is in their best interests.

Third, direct monetary incentives would also encourage energy conserving investments. A.S. suggested a rebate to the customer if the annual utility bill were under some fixed amount, say $500. The rebate could come either directly from the utility or as a tax rebate from state or federal governments. This approach would encourage tenant conservation as well as owner conservation since the benefits of such conservation would accrue to the consumer directly.

Fourth, if PG&E offered insulation financing (greater than the current limit of $500) at low interest rates, the management company would consider promoting retrofit insulation among the owners. Usually the owners' accountant is responsible for encouraging such investments, according to A.S.

A.S. suggested appliance dealers as being the best leverage point for pushing energy conserving appliances. The company buys all its refrigerators through one dealer since, in this way, it receives a volume discount. The only real consideration in such purchases is initial cost. The company has recently switched from buying used refrigerators to buying only new ones because used refrigerators are getting harder to find and more expensive to repair (as well as needing more repairs).

A.S. seems to be explaining, in several different ways, why his company has no direct interest in energy conservation. Because the energy costs are passed through, there is no benefit to his company to lowering the bills, and therefore, there is no incentive to seek out information on energy conservation or to promote it in any other way.

Case 4: W.F., Apartment Complex Manager

W.F. is the administrator of a large apartment complex in the Bay Area. He is much more cynical (realistic?) about how to motivate people; fear and greed are the key elements in his opinion. The apartment complex contains more than 1000 apartments, swimming pools, tennis courts, racquetball courts, a small shopping center, and a restaurant or two. It is virtually a self-contained community.

The only energy conservation measure undertaken has been to switch from a master meter to individual submeters. The re-metering took about six months and cost $350,000. The apartments are all-electric. Prior to the re-metering, the electric bill was about $30,000 per month on the average, with a high of about $40,000 per month. PG&E estimated that 55 to 60 percent of the usage was unnecessary, and in spite of the limited data currently available, it is clear that the re-metering has resulted in a substantial reduction in electric use. The energy wastage was caused primarily by residents leaving the living room thermostat set at 75^{o} and using the

manually operated bedroom and bathroom heating units to correct the indoor temperature, or opening the windows to cool off the apartment with the heaters on. The switch to paying for individual electric use is being phased in as units come up for lease renewals or are re-rented. The rents are not being increased nor are they decreased; rather, tenants are told that in lieu of a 5 percent increase, they get to pay their own electric bills. Approximately 800 units had been converted to "pay your own bill" status as of August 1978. The incentive for re-metering came from the decision by the owners to convert the complex to a condominimum complex: the first step in this process was to get each unit separately metered.

W.F. has several observations on conservation in general.

First, swimming pool covers were ordered during the water crisis, but the order was cancelled as soon as the rains came. No serious consideration has been given to the use of pool covers for energy conservation.

Second, the use of solar water heaters for the pools is being considered because a solar contractor walked in and offered to give an estimate. The contractor hasn't returned with the estimate, however, so no action has been taken on this.

Third, the complex buys all its appliances through a dealer who gives apartment owners a good deal. The only consideration in appliance purchase, aside from deciding what size is needed, is the first cost. If the dealer were to push energy conserving appliances, W.F. would consider buying them, but he is not interested in having to do comparison shopping.

Fourth, the complex management distributed "vast quantities" of PG&E energy conservation literature every sixty days while the re-metering was being done, to get tenants aware of what they could do to keep their electric bills down. PG&E estimated studio apartments would see a bill of $8/month, one bedroom apartments $11/month, and two bedroom apartments $17/month, which would be about two percent rent increases, because studios rent for about $250-275, one bedrooms for $350-400, and two bedrooms for about $425-465/month. The management saw the use of PG&E literature as a way to avoid a tentant revolt.

Fifth, W.F. likes to see a two-year payback for investments generally, although something like a solar pool heater could have a five-year payback or so because the investment would be for the community areas, should increase the value of the complex, and would reduce utility bills.

Sixth, W.F. expects tenants to insulate once the complex becomes condominiums, for soundproofing. Now that the units are no longer master-metered, W.F. is not interested in insulating for energy conservation.

W.F.'s final point was that the only motivating forces he believes exist are fear and greed. In the absence of these forces, no energy conservation will be done. So, energy conservation must be shown to be highly cost effective or it will not happen without statewide regulations to force point-of-sale retrofits, etc.

All four of the first interviews mention cost effectiveness or economic factors as playing important roles in energy conservation decisions. However, many of these decisions are based on subjective impressions of the cost effectiveness of energy conservation rather than on specific data and calculations. As the next set of interviews shows, the same subjectivity can be found in the commercial building sector.

B. Interviews with Managers, Owners and Operators of Commercial Property

Case 5: B.P., A Shopping Mall Maintenance Supervisor

B.P. is the maintenance supervisor at one of the regional shopping malls in the Bay Area. The company he works for owns only the mall itself; the surrounding property, including the parking lots, belongs to the local city. The mall has a brick-block exterior with no insulation. The roof is insulated and has about 200 skylights, which are all single thickness, clear plastic bubbles.

The electric system has two "house meters," which measure electrical usage in the mall administrative offices and general mall areas (walkways, public restrooms) only. The tenants of the mall are all metered separately.

The electrical usage in the general mall areas is attributed to the air conditioning system, elevators and escalators, lights, and the cooling towers. The air conditioning system consists of eight 40-ton units, half of which are set at 72^{o} and half at 76^{o}. Except on very hot days, only four units are operated at a time. The air conditioning units serve only the general mall areas. The mall has one passenger and four freight elevators, and six escalators. The only gas usage is for winter heating.

B.P. has done several things to conserve energy. The 150-watt spotlights have been replaced with 75-watt bulbs, fluorescents, and the gas heaters remained off all winter. The lighting ideas evidently originated with the company's national maintenance supervisor. The heaters were never turned on last year because B.P. waited until it got cold instead of turning the heaters on around October 1st, and nobody ever complained of the cold, nor did the temperature ever drop enough for B.P. to feel the heaters were necessary. Some electricity waste has been found in lights left on in the unoccupied spaces of the mall (which is about 60 percent occupied). The doors to the freight bays are also left open on occasion, allowing cooled air to escape.

This source of heat/cold loss is well known and checked regularly. As far as future energy conservation is concerned, B.P. says they've done all they can; the only thing left is to turn off the lights, and customers would probably complain if that were done.

The rental cost runs about $15-20/square foot/year, depending on location and total square footage. B.P. could give no estimate of energy costs in the general mall areas and was visibly uneasy about being asked what they are. The company has no way to force tenants to conserve energy but did recommend such things as Watt-Miser fluorescent lights. B.P. indicated that some tenants were happy to conserve and others were totally disinterested.

Case 6: P.R., A Commercial Office Building Manager

P.R. is the property manager of a ten-story structure with about forty tenants. Energy conservation in the building so far has included delamping in the halls, the purchase of an "optimizer" for the air conditioning system, several operational changes, and using the security guards as energy monitors. The delamping was done prior to January 1978. The optimizer was purchased recently for between $3000 and $5000 and has reduced the PG&E bill by $1000 to $1500 per month. The operational changes have included turning off the air conditioning after certain hours and on Sundays. The security guards monitor energy use as they come on duty by checking every office suite for lights, Xerox machines, and typewriters left on. They report such lapses to the owners, and memos are sent to tenants who are repeat offenders.

The two main forces for energy conservation in the building are the building engineer, and one of the partners in the joint venture which owns the company. The building engineer is rumored to be very competent and enthusiastic about reducing energy use, and the partner is very cost-conscious.

P.R.'s experience with other property management firms is that they usually don't have a large enough cash flow to be able to "afford" energy conservation improvements. When asked if low interest loans for energy conservation would help, P.R. said most of the companies would rather use additional funds to invest in more real estate than to improve existing investments.

Case 7: J.R., Developer of Small Commercial Buildings

J.R. is one partner in a firm of developers located in San Leandro. The company builds one-story concrete tilt-up buildings, which can be used as offices, warehouses, or as parts of shopping centers in suburban areas. The company develops the site and then leases space to tenants.

J.R. is very interested in energy and concerned about energy conservation from several perspectives. One perspective is the cost of energy to tenants, which he estimates is around 10¢/square foot/month, or about 25 percent of the rent. His experience has been that if a building is fairly energy-conservative but the rent is marginally higher due to the increased construction costs, the building is much harder to rent. Tenants are aware of energy costs, but are not willing to pay slightly higher rents to obtain substantial energy savings in the long run. J.R.'s comment was that the rental market is not always logical and his ability to provide socially desirable energy conserving buildings is limited by what he can rent. A very energy-conserving building is not profitable if it can't be rented.

Another of his concerns is the new construction standards. Concrete tilt-ups do not meet the heat loss requirements in the standards that were slated to take effect July 1, 1978, but have been delayed by the courts. The tilt-up technology is well-developed and J.R. thinks that it is fairly elegant. The new standards may well put him out of business. The major technical problem is the lack of adequate "under ceiling insulation" to meet the standards. Currently insulation is placed either under the roof or just above the false ceiling. Both of the techniques are less expensive than placing insulation on top of the roof, which is the only technique that meets the new standards. Unless a new technique is developed, concrete tilt-ups will most likely be priced out of the market.

In response to specific questions, J.R. indicated that his firm does retrofit their buildings for energy conservation when tenants move out, but that the final solution is to sell any building that is uneconomic to rent. This means that if it is uneconomic to retrofit a building to get the energy costs to a reasonable level, the building is sold and someone else deals with the problem.

J.R. was speaking as a member of the private sector, and feels strongly that the major barriers are distrust of the public sector and changing regulations, technology and costs. The two major concerns of builders are that they will be left holding the bag as costs drop due to new technologies or changing standards (the example of Hewlett-Packard calculators going from $850 to $50 was given), or that they will be laughed at. "Being laughed at" refers to developers who were forced down a particular path by government regulation and then at some point the government agency said, "Gee whiz, we're sorry, but you can't build that here." In at least one case the agency forced the developer to conform to very stringent new regulations and at the last minute decided the regulations were too stringent and threw them out. The result of such behavior on the part of government agencies has been to discourage builders and developers from complying with the law willingly and promptly. Delaying tactics are seen as much more effective than compliance in terms of cost reductions.

The EPA was identified as the primary cause of distrust. It is seen as not responsive or sensitive to private sector needs, and as gleefully setting up regulations designed to put developers out of business. The California Energy Commission is characterized as full of youngsters who don't know or care what the impacts of new regulations will be on the private sector.

The trade associations are getting active in fighting new regulations with the support of individual developers.

Delaying tactics are used because of changing technology as well as changing regulations: in six months many new energy-conserving designs will be out and some will replace existing designs. J.R.'s buildings are maintained by the tenants, with the exception of a checkup of the heating and air conditioning systems several times a year. The checkup is done by a small HVAC maintenance firm retained for this purpose. The maintenance firm has no interest (according to J.R.) in energy conservation. If you want something done, you specify it to the firm and they will do it, but don't ask them to think for you.

Case 8: J.G., Chief Engineer of a Large Office Building

J.G. is chief engineer of a large office building in downtown San Francisco. He works for the management company that operates the building for the owners. J.G.'s background is in data processing, and he originally planned to work for the telephone company. By chance he heard that this new building was installing a computer and was hired in part because of his interest in programming the computer. As it turned out, the computer operation had been subcontracted out and he was unable to become involved with it. A few years later he became chief engineer for the building. He is currently studying for his citizenship test.

The building was completed in 1968, prior to the Arab oil embargo of 1973; consequently, energy conservation was not an important consideration in the original design of the building. The building has 1,350,000 square feet of rental space. There are three equipment floors. The first houses three 1,750-ton chillers, a small computer and a remote control center. The other two floors have the majority of the air handling equipment. The HVAC system is designed around a perimeter and quadrant approach. The primary heating/cooling effort conditions the air in each of four quadrants on each floor of the building. The secondary system is a perimeter system, with four sides corresponding to the four sides of the building: north, south, east, and west. The perimeter system has units located next to the windows, which are occupant-controlled. Each quadrant has a single lighting control. Individual heating areas are thermostat-controlled.

The equipment on all the equipment floors has been color-coded by function: all the secondary system pipes are painted light blue, the primary system pipes dark blue, etc. This was done to enable the maintenance and engineering crew to easily identify various pieces of equipment. Of the 12 members of the crew, about 75 percent are able to operate all the building's controls and fully understand how the system operates. This appears to be highly unusual. Other large buildings have equally large crews, but only one or two individuals can operate any of the controls, according to J.G.

J.G. is very interested in energy conservation and efficient building operation. When he became chief engineer, he re-vamped all the control boxes so that now one can spend two to three minutes studying the boxes and know exactly how all the controls are connected. The difference between the original spaghetti diagrams and the current situation is extraordinary.

The major reason the building is fairly energy efficient is J.G.'s interest in conservation. The owners are not interested or willing to spend money to conserve energy. The management firm is likewise uninterested (they pass energy costs through to the owners), and so all the conservation measures implemented so far have been done at no cost (aside from labor costs). Some of these measures include raising the cold water temperature from 39^{o}F to 43^{o}F in the summer and perhaps as high as 50^{o}F in the winter; dropping the temperature in the heat exchangers from 140^{o} to 100^{o}; and attempting to get the janitors to shut off the lights in each quadrant as they finish working, so that by 10:00 p.m., half the building should be dark. The janitors have not been very consistent with this practice, however, which J.G. feels is a combination of factors: the turnover rate is high among the cleaning staff, and most of them don't speak English, so the crew foremen have to interpret for them in either Spanish or Chinese. Many times the foremen evidently forget to instruct the new employees to turn off the lights.

One of the major sources of energy use is a computer room (located next door, but cooled by the building's HVAC system). J.G. figures it costs $2,000/day* to cool the room, since a 1750-ton chiller is used at partial capacity to cool a room of about 400 square feet. He has been unable to convince the owners that it would be cheaper to either move the computer room or to buy a separate (and smaller) cooling unit.

J.G. feels that energy conservation efforts would occur more quickly if management were interested in doing more. In spite of lack of such interest, he has found it possible to do some energy conservation. In 1977, steam costs were about $148,000 and electricity costs were about $1,245,000. (Both steam and power come from PG&E.) This figures out to just over $1/square foot/year for energy.

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*This seems somewhat high since total electricity costs in 1977 were $1,245,000. However, a 1750-ton chiller with a COP of 3 would have cost about $2000/day if operated at <u>full</u> capacity.

However, in J.G.'s building, floor space rents for about $13/square foot, so the energy cost is only 8 percent of the rent, compared to about 25 percent of the rent for J.R.'s buildings. The yearly energy savings was $400,000 in 1977, compared to usage at 1973 rates but at 1977 energy prices.

J.G. has plans for several additional conservation measures. A major effort has been made to get the building operations computer replaced. It was obsolete before it was ever operational in 1971; it has never been completely debugged; spare parts are non-existent; it was the first of its kind; and its optimization programs have never run. J.G., who became chief engineer around 1973, was unable to get a replacement unit until he managed to tie it to a fire safety program the building is conducting. A new computer is now being installed and will be wired into the building as the wiring system is exposed as part of the fire safety program. The tie-in with fire safety involves having the computer switch from inside to totally fresh air in case of a fire, to blow the smoke out of the building. The new computer will also make it possible to run the building more efficiently.

Other ideas include having tenants put in individual room switches for lights whenever substantial remodelling is done; doing some window treatment to the south and west sides of the buildings, and installing a voltage reduction unit for the fluorescent lights. The remodelling scheme is already building policy, and the window treatment project is about to be submitted to the management. The window options are retrofit awnings, re-grooving the windows and adding an additional pane of glass, or adding reflecting film to the windows. The awnings idea was discarded early by the owners for aesthetic reasons. The estimates for the other two ideas are $1.2 million to re-groove the windows and about $250,000 for reflecting film--to only cover the south and west windows. Window temperatures in the south currently get up to 130° to 140° so that frequently the south side needs cooling while the north side needs heating. Window treatment of either kind would reduce this differential.

The voltage reduction idea is being held in abeyance because costs for this are falling rapidly, and there is still some doubt about the effect on fluorescent light lifetimes. J.G. is keeping tabs on the technical developments, but doesn't expect to submit a proposal to his board of directors in the immediate future.

The costs for energy conservation have, up to now, been minimal. The owners have not expended extra funds; the work has been done as part of the normal buildings operation and maintenance program. The window treatment program will be the first project for which the owners are asked to lay out funds for an idea whose major purpose is to conserve energy, and it seems likely the "increased comfort" aspects will be stressed greatly in the presentation. The owners' response to this request for funds will be a good indicator of how committed they are to energy conservation.

These interviews all involved people in the commercial building sector, but their experience and expectations are considerably different. B.P., the maintenance supervisor, apparently has come up through the ranks, does what he's told to do about energy conservation, but has no real understanding of how the energy problem is relevant to his job. He has developed no creative solutions or ways to conserve energy, but energy and energy conservation are just minor parts of this job. His basic objective is to keep the mall tenants and customers happy.

P.R., the property manager of the ten-story office building, seems to have no interest in or understanding of energy conservation. Energy represents only a small fraction of the operating costs of the building, yet some conservation measures have been done in an effort to reduce them by a cost-conscious partner. The cash flow problem she brought out may explain a number of observed phenomena in energy conservation.

J.R., the builder/owner, is much more interested in conservation. He is informed about energy use and conservation and has a clear understanding of the problems involved in actually implementing energy conservation. His decisions on energy conservation are clearly based on rental costs, market surveys, and what the competition has to offer. The lack of trust between the public and private sectors, which he identified as a major barrier to energy conservation, gives some insight into why the building industry feels delaying tactics are usually a better option than immediate and whole-hearted compliance with new regulations.

The last of the four commercial sector interviews with J.G., the chief engineer of one of San Francisco's largest office buildings, has a very different flavor. J.G. is very interested in energy conservation, probably because of the tie-in with computers. In spite of a lack of management support, J.G. has done a substantial amount of energy conservation. He has encountered some interesting and unsuspected problems such as the language barrier and high turnover rate in the janitorial staff. And although much of the energy conservation work has been justified, based on its cost-effectiveness, the motivating factors for J.G. may be a desire for personal satisfaction, a belief that conservation is "good," and the desire to make use of certain special skills and tools, i.e., the computer.

C. Interviews with Other People Involved in the Buildings Sector

The owners and managers of buildings are not the only individuals involved in the building sector of course. The next four interviews are with some of the other "actors" in this field: a broker-investor, an owners association representative, a sales representative for an insulation contractor, and a low-income housing advocate.

Case 9: D.B., A Broker-Investor

D.B. works for a realty company and is part owner of several apartment buildings. He manages the apartment buildings for his other partners or other owners for whom he acts as an agent. The partnerships range from three to four people to 18 owners.

The economics of apartment buildings dominated the conversation. Tax credits help drive the economy, especially the seven percent investment credit. These tax benefits allow the wealthy to carry property for ten to twelve years. Without such benefits, private industry would not build houses, so the government would have to. For individuals in the 60 to 70 percent tax bracket, investments in housing avoid tax liability and are seen as money-making propositions even if there is little or no cash flow. Doctors and lawyers and others who make $50,000 to $100,000/year may have $30,000 or so to invest. They don't care about a cash flow because they are really only interested in "banking" the money in property to match inflation and then paying capital gains on their lowered income after they retire. This in turn makes it hard for the small investors to compete, those who want to make a little money now. Also, the competition by those who are "banking" in property tends to drive prices up. Currently, the apartment/commercial building field is filling with inflation-conscious buyers who want inflation-proof investments.

D.B. is concerned because he feels the apartment house industry is not a money-making institution at present. The ideal situation is to have a low mortgage payment and get the profit from rising rents. Inflation hits property owners like everyone else, and at the same time there is strong pressure to keep rents down. Rents are historically slow to keep up with inflation. In the past five to ten years, rents have increased on the order of 60 percent, while housing costs have gone up 120 to 140 percent. Interest rates are high (10½ percent to 11 percent) and he can't find anything worth buying.

Another major area of concern is the management companies. D.B. doesn't believe most property management firms do a good job of financial reporting. D.B. uses one to manage his property, but he prepares monthly expense and year-to-date lists to compare with earlier years and months. The company he uses never looks at such yearly expenses. (One reason for this is that absentee owners don't care.) D.B. finds that usually such owners have an on-site manager, low rents, and low levels of insurance. When he moves in, the costs do go up because he has a professional firm manage the property, and extra expenses do exist, such as more insurance and better tax preparation.

In talking about energy conservatin, D.B. says the hardest part is getting the tenants to cooperate. It's especially hard to reduce hot water use, since the hot water is centrally supplied and the owner, not the tenant, pays for it directly. D.B. has considered switching to fluorescent lights in some areas, but the effort involved in finding out what lights are available, how much they cost, and the difficulties in computing the expected savings have discouraged him and kept him from doing more than just considering the possibility.

He has also considered re-metering and has done some. He and his partners spent between $10,000 and $12,000 to convert a 15 unit apartment house to individual space heating, since the partners were refinancing the apartment. PG&E estimated they would save $100/month on gas, and D.B. feels sure the savings have been more than that because gas prices have gone up. However, it will take ten years to amortize the investment, and the $12,000 could be doing something else; so other owners might not have found the investment attractive. In another re-metering case, the cost for a four unit building was going to be $800, or $200/unit, which was simply too expensive in this case. He doesn't believe in milking an apartment and selling it. This attitude is reflected in his investments for conservation and his interest in solar hot water heating for apartments.

Energy conservation in apartment houses boils down to economics, and in older buildings, attic and floor insulation may not be cost effective. The apartment industry needs tax benefits comparable to those offered to single family residents to install such things as solar heating.

The point-of-sale retrofit proposal for Berkeley would have the effect of increasing the sale price and hence would slow down the turnover in apartments. Also, the increased sale price would make it even harder for the small investor to buy, and would lengthen the time between purchase and a positive cash flow for income.

The carrot approach to energy conservation, such as PG&E's financing scheme, is the most appealing to D.B. But, he doesn't know anyone who has actually taken advantage of it. Part of the problem may be that most owners don't know much about real estate or energy conservation, and so it is fairly hard to convince them to save energy in

the apartments or to demonstrate the savings possible in an understandable way. It is also difficult to retrofit a three-story apartment house. Where do you insulate: the roof and basement, but what about the walls and interior floors? The work and mess of drilling two holes every 16" to put in wall insulation makes this measure unappealing, and tenants would have to be disturbed, which is an additional drawback.

Adding weatherstripping or caulking would probably be good, but tenants don't keep windows closed, even with the heat on. Getting them to be energy-conscious would be as difficult as keeping security buildings secure; tenants are continually bypassing the system by leaving keys in the garage for their friends, etc.

Many owners would allow tenants to do the work and be willing to pay for material but would probably want to impose some limit "so a ten dollar job doesn't end up costing fifty dollars."

Berkeley is extraordinarily sensitive to energy and other issues, but the questions of "How much does it cost?" and "How much can I save?" remain. Few people D.B. knows are willing to spend money "for the future," and when a simple roof repair job on an 18 unit building for the present inhabitants costs $2000, clearly more complex energy conserving improvements are going to be very costly.

Case 10: S.S., An Owners Association Representative

S.S. works for an association of building owners. The association is involved with several energy conservation issues. They are protesting the California Energy Commission's (CEC) proposed energy budgets for existing buildings because they expect the budgets to be totally unrealistic. The association also negotiates union contracts with engineers, elevator operators, and janitors and is involved in a fight with the janitors' local over whether janitors can be required to turn off lights in the buildings. The proposal is to have the entire janitorial crew clean one floor and then move to the next, etc. Fewer lights would be left burning in the building, thereby cutting operating costs. This idea is referred to by the unfortunate name of "chain gangs." The union objects because janitors would no longer have their own area to clean. The association is not too hopeful that they will succeed in persuading the union. Other companies do use such chain gangs, but they have non-union labor.

S.S. feels that the CEC regulations are not good, but also feels that voluntary cooperation won't work. Mandatory measures will be necessary,but the CEC proposal is not the right one. The association does not have an alternative but is working with and listening to others in the industry in search of good ideas.

One interesting barrier to energy conservation which S.S. mentioned was a possible conflict with Cal-OSHA regulations. The operator of one new building asserted that he's conserved so much energy and reduced temperatures so much that if he did any more, he would violate Cal-OSHA temperature standards in the public areas of his buildings.

Most management firms work on a flat fee, cost pass-through basis, according to S.S. Both managers and owners are interested in energy conservation as a way to reduce operating costs, but that is the only incentive. There is much energy conservation information available, but it is difficult for individual managers to evaluate it. Several firms will guarantee their work, but other firms are too new to have a track record. Therefore, it requires some individual initiative to search out viable alternatives.

The last problem S.S. mentioned was with older buildings with 35,000 to 40,000 square feet. These buildings tend to be leaky, hard to retrofit, have old boilers and old elevators, and are slated for destruction in the near future. Hence, energy conservation improvements aren't seen as cost-effective and aren't made.

Case 11: M.W., A Sales Representative for an Insulation Contractor

M.W. works in the office of an established insulation contractor. She says the major reasons people insulate are for comfort and to reduce drafts on the floor. In the summer, air conditioning units don't have to run all day if the attic and exterior walls are insulated. Heat is also used less, but this is less of an incentive to insulate than reducing air conditioning use.

The company does lots of advertising and also door-to-door solicitations. However, the door-to-door people provide advertising and solicit phone inquiries; they do not make sales. Telephone advertising, the Yellow Pages and many phones are used to keep the public aware of the company's existence and reputation. The company uses blown-in cellulose, treated with some kind of fire retardant. M.W. did not know what kind.

PG&E's loan program has produced many phone calls inquiring how homeowners could take advantage of it. It has helped business. A tax deduction would also be attractive to many people. If insulation were mandated by the state, only cost would be considered by individuals. Quality and workmanship would not be looked at, and so small incompetent firms would probably make a killing at the company's expense, according to M.W.

Case 12: K.W., A Low-Income Housing Advocate

K.W. is trying to organize tenant unions in Oakland. She discussed the general concerns of low income inner city dwellers.

In low income housing, energy conservation does not have high priority. "Habitability" issues, such as leaky or non-functional plumbing, cockroaches, rats, and broken stairs and windows have the highest priority. Most of these issues are covered in health and safety regulations which are simply not enforced. Cities claim that requiring landlords to repair structures to meet "antiquated" buildings codes will only raise rents and get renters evicted. Therefore, cities do not follow up on building code violations, and courts are not sympathetic towards tenants who ask for court-mandated help.

Energy conservation is also not important in places like Oakland, according to K.W., because people don't use heaters. They have minimal electric and gas usage, and hence the benefits of energy conservation would be hard to see in financial terms. Most apartments are individually metered in Oakland.

The real estate lobby is very active and effective in preventing legal changes that could benefit tenants and renters. Until this lobby can be overcome or removed, low income habitability issues will not be resolved. And until low income housing meets basic habitability requirements, energy conservation won't be a viable issue for low income renters.

K.W. said that the YMCA plans to create an "energy squad" using 15 to 21 year-olds who are either high school dropouts or unemployed. The squad will learn to do weatherstripping, etc., and their services will be offered to the elderly in Berkeley.

These case studies provide another set of diverse perspectives. D.B., the broker-investor, is most concerned with the financial aspects of real estate. His conversation provides examples of how the tax laws can affect the incentives for conservation. He also gives a striking example of the importance of financing. In one situation he describes, owners are willing to invest more than $600 per unit to eliminate master metering because their property is being refinanced anyway. In another situation, owners are not willing to go "out-of-pocket" $200 per unit to eliminate master metering.

S.S., the owners' association representative, is concerned with the impact of regulation on the interests of the associations members. The association stands between the owners and government and other organizations such as unions. S.S. cites examples of regulations that inhibit energy conservation (union work rules and Cal-OSHA standards) but opposes the CEC's energy conservation standards. While S.S. concedes that some energy conservation regulations may be necessary, the present tactics of his association seem to be directed at delaying the implementation of standards; it has not yet developed constructive alternatives.

M.W., the sales representative for an insulation contractor, believes that the market for her product is based more on the consumer's desire for comfort than on an interest in saving money or energy. Surprisingly, she seems to oppose regulations that would increase the demand for insulation. Perhaps the insulation market structure is such that existing firms would be reluctant to increase their capacity to meet (possibly short term) increases in demand.

K.W., the low income housing advocate, sees energy conservation as a diversion from more important issues. However, she is interested when energy conservation becomes a vehicle for providing jobs and economic development.

The heterogenity of views expressed in all of the interviews reported above may leave the reader a bit bewildered. Yet our little sample hardly does justice to the complexity of the buildings sector. A number of the important actors including architects, tenants, homebuilders and homeowners are not represented. A much more extensive and systematic study would be required to really cover the field.

The complexity revealed by our interviews notwithstanding, most of the barriers that are encountered can be sorted out with our taxonomy and some common themes do emerge. A concern with costs is coupled with a lack of information on what the costs are and what the effects of conservation might be. The problem of misplaced incentives recurs in many forms. Further work is clearly required before we can say with certainty what is the impact of these barriers. But we do have a starting point both for continued analysis and for beginning to examine possible strategies for overcoming barriers.

IV. OVERCOMING BARRIERS

A. Strategies

Given the existence of barriers to energy conservation, what should be done to remove them or at least minimize their impact? To answer this question, we need to first to determine what strategies are available for overcoming barriers and then to evaluate the feasibility, costs, and benefits of these strategies. Energy conservation strategies can be divided into six categories: informing, leading, market-making, rule-making, pricing, and rationing. In what follows, we explore the nature of these strategies and propose some criteria to be used in their evaluation.

- Informing. Where lack of information is a barrier to energy conservation, the government can act to provide information in several ways. First, the government can produce new information by sponsoring research; second, it can facilitate the flow of existing information by supporting libraries and indexing services; third, it can communicate information directly to users by providing education and training.
- Leading. The government can attempt to encourage energy conserving behavior by leadership. This can be done by example, such as the President setting down the White House thermostat and wearing a sweater, or by persuasion such as the familiar "Don't be Fuelish" advertisements. While the objective of leading is to alter social norms of behavior, this may not be unrelated to the problem of market failure. As Kenneth Arrow has pointed out, "There is a whole set of customs and norms which might be similarly interpreted as agreements to improve the efficiency of the economic system (in the broad sense of satisfaction of individual values) by providing commodities [Arrow proposes trust as an example] to which the price system is inapplicable."*
- Market-Making. Government actions can create markets for energy conserving products or services. One way to do this is through purchasing policies. The government's buying power is sufficiently great that simply indicating a desire to purchase an item for use in government operations will often suffice to create a market. Considering the volume of government purchases of energy consuming equipment--cars, lights, buildings, etc.-- there is considerable

*Arrow, K.J., "The Organization of Economic Activity: Issues Pertinent to the Choice of Market Versus Non-Market Allocation," in Haveman, R.H. and Margolis, J. (eds.), Public Expenditures and Policy Analysis, p. 59, Markham, Chicago (1970).

scope for applying this strategy to energy conservation. The government can also create markets in the role of entrepreneur, undertaking development and demonstration projects. The most familiar examples of this strategy are large scale projects such as commercial satellites, but the strategy can also be applied on a scale more appropriate to the needs of energy conservation. A third approach to market-making is the role of financier. The government can underwrite loans to facilitate the development or marketing of energy conserving products.

- Rule-Making. Much of what government does involves making rules, but we are concerned here with rules in a rather narrow sense; that is, rules for commercial transactions. Rules can affect what is sold and who is permitted to buy or sell. For example, rules can require that all residential property be insulated before it is rented or sold and rules can prohibit the practice of master-metering so that tenants, and not landlords, pay the utility bills. Rule-making can also be used in support of other strategies. For example, rules can require landlords to disclose to prospective tenants whether their apartments are insulated (informing), rules can prohibit anti-competitive practices (market-making), and rules can reinforce norms by prohibiting or limiting certain kinds of consumption (leading).
- Pricing. Government policies can influence the incentives to consume or conserve by changing the net price of energy or energy consuming and conserving commodities. In energy, one way the government exerts its influence is as a seller. A significant part of the Nation's electricity is marketed by government agencies, the government can lease vast tracts of land which contain fossil fuels, and it has a monopoly on uranium enrichment. Prices can also be set by regulation. Prices for natural gas, oil, and electricity are all controlled in this way. A less direct influence on prices can be exerted through taxes which increase the net price or subsidies which decrease the net price. Examples of taxes include the gasoline tax and the proposed windfall-profits tax; examples of subsidies include the oil depletion allowance and the tax credit for home insulation.
- Rationing. In principle, the government can use rationing to conserve scarce resources by limiting consumption to some predetermined "correct" value. However, in practice, rationing is usually used to allocate scarcity. That is, when some commodity becomes scarce (and particularly when the scarcity is dramatic and

sudden as in times of war) society may choose to ration the commodity in preference to allowing price rises so that the burden of scarcity will be borne more equitably. The priority system now in effect for natural gas users is an example of this kind of rationing.

B. Criteria for Evaluating Strategies

At this point, it would be convenient if we could introduce a simple procedure for comparing strategies so that we would be able to decide what strategy is most appropriate for overcoming a given barrier to energy conservation. One is tempted to seek some way of ranking different strategies with a single index, say a cost/benefit ratio. But, in practice, the criteria against which we will want to weigh the different strategies are not always easily translated into a common measure such as money. This is a familiar problem in public policy; policy makers spend a good deal of time trying to compare apples and oranges. Ultimately, one is almost always reduced to subjective judgments.

While subjectivity may be unavoidable, there is no need to be altogether arbitrary. Policy makers should be aware of a number of factors that are relevant to the choice among energy conservation strategies so that their decisions can at least be informed. These factors can be divided into two classes: those that relate to the efficiency of a strategy in achieving the goal of energy conservation, and those that relate to the impacts of a strategy on other (possibly competing) economic and social goals. While these two classes of factors may interact strongly, it is useful to examine them separately.

1. Efficiency

- Direct Costs and Benefits. A first step in evaluating the efficiency of a strategy is to try to determine the direct costs of implementing the strategy and the savings that will be achieved if the strategy is carried out. This sounds simple, but is often not easy to do. For example, while it is fairly easy to estimate the direct cost of an information program, it is quite difficult to decide how behavior will be changed by additional information.
- Political Feasibility. Next, one must try to evaluate the chances that a strategy will in fact be carried out. There are many aspects to this question, but the one that usually preoccupies policy makers is political feasibility. That is, will the strategy be acceptable to the various constituencies

who have the power to determine whether or not the strategy is adopted as government policy? This depends to a large extent on the temper of the body politic. In times of crisis, it may be possible to use "steam-roller" tactics to overcome barriers. Old rules and old ideas can be dispensed with in short order. Social pressures can be brought to bear on recalcitrants and new regulations become almost self-enforcing. But, in more normal times, changes are not made so easily; commitment to the status quo is stronger and strategies must be more subtle.

The problem of political feasibility places the energy planner in a paradoxical position. On the one hand, he is supposed to devise strategies which will avoid crisis, while, on the other hand, he knows that a crisis provides the best opportunity for launching his strategies. Thus, it is necessary to evaluate strategies both for their effectiveness in avoiding crisis and for their effectiveness in preparing us for crisis. For example, strategies that develop the "infrastructure" of energy conservation, such as programs to train professionals in conservation technology, will enchance our ability to cope with the crisis. But, such strategies will be rather slow in changing existing consumption patterns. Other strategies, such as rationing, can have an immediate effect on consumption patterns without much affecting our ability to deal with future crises. Clearly, one must make judgments both on the immediacy of crisis and on the likelihood that any politically feasible strategy can avert crisis.

- Implementation. There is a tendency for policy makers to assume that, once a policy is adopted, the government agencies that are responsible for carrying it out will perform in ways that are consistent with this responsibility. Unfortunately, this is not always the case; there are in fact many barriers within government agencies to the implementation of strategies. Many of these barriers can be analyzed in the same terms as those we used to describe barriers to energy conservation. For example, implementation often requires cooperation and teamwork within and between agencies, but the structure of bureaucracies often provides little or no reward for this kind of behavior; this is a problem of misplaced incentives. Examples of implementation barriers resulting from lack of information, regulation and customs are also not hard to find.

Some observers see the implementation problems as so severe that they are reluctant to support government initiatives even when market failure is clearly evident. They believe that such initiatives are too likely to make the situation worse. One need not be so pessimistic about the efficacy of government action to recognize that implementation problems can be very serious. However, not all strategies are difficult to implement, and care in the development of strategies can make implementation easier. Strategies can be designed with incentives for those who must carry them out. Simple strategies that do not require coordination between numerous agencies or interest groups are to be preferred over complex strategies.

- Leverage. Another element in the design of strategies that can increase their efficiencies is leverage. Where possible, strategies ought to focus on high leverage points. An example of a strategy that does this is a California Energy Commission project to modify licensing examinations.* This project is working with several California licensing boards (including architects, engineers, and contractors) to help them incorporate energy conservation questions in the examinations that are given to qualify their licensees. If this project succeeds in establishing some knowledge of energy conservation as a requirement for entrance into occupations that have significant influence on energy consumption, then its effects will propagate in two directions. It will affect the training programs for these occupations, as well as the way in which these occupations are conducted.

2. Impacts.

Even the most efficient energy conservation strategies can be unacceptable if they conflict too strongly with other economic and social goals. Among the impacts of conservation strategies that should be evaluated in this light are effects on economic growth, income distribution, employment, land use patterns, lifestyle, and individual freedoms.

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*Wilms, W.W., Promoting Energy Conservation through Occupational Licensure; A Feasibility Study, Berkeley, California: Lawrence Berkeley Laboratory, 1977. LBL-5996.

Often there is a good deal of ambiguity in assessing these effects. For example, modifying building codes to require additional energy conserving features in new residential construction will tend to increase the labor needed to build a house; one might expect increased employment in construction as a result, but added features will also tend to increase the first cost of a house. If a significant number of potential home buyers cannot meet the increased down-payment requirements, the overall result of the code changes may be to depress the housing market and consequently to decrease employment in construction. (Most energy conserving code changes now being considered are cost effective at present energy prices and so would not be expected to depress the housing market unless there were a serious financing barrier.)

Building code changes also provide examples of a number of other potential difficulties. If codes prescribe specific features, they may create a barrier to innovation. For example, one might propose to limit window area since windows are a major source of heat loss. However, this could inhibit the use of passive solar designs which require large window areas on a southern exposure. As codes grow more complex, they tend to prevent builders not familiar with the codes from constructing their own homes. This not only inhibits a type of individual initiative that is highly prized in our society, but also may tend to increase the price of all housing by lessening competition. Building codes also restrict the individual's freedom of choice. For example, a prospective owner who feels that the aesthetic value of a large expanse of glass on a northern exposure is worth the extra energy cost may find that this choice is foreclosed.

Some of the problems with building codes described above can be dealt with by refining the strategy or adding subsidiary strategies. For example, instead of prescribing specific features, the codes can set an overall peformance standard. Amateur builders can be assisted by training programs and subsidies. However, the potential conflict between an individual's aesthetic interest and society's interest in assuring an energy-efficient housing stock is very difficult to resolve within the framework of building codes.

As the example of building codes shows, the effects of a strategy can be far reaching. The analyst who involves himself in the assessment of the impacts of energy conservation strategies (or almost any other government action) soon discovers a law of policy analysis: "Everything is connected to

everything else." Because of this complexity, unexpected and unintended consequences will almost inevitably result from any strategy. This leads us to suggest "flexibility" as a final criterion for a good strategy. That is, when the unintended consequences of a strategy are adverse, there should be ways to make adjustments; when strategies fail, there should be ways to terminate them.

V. CONCLUSIONS AND RECOMMENDATIONS

If one is concerned with overcoming social and institutional barriers to energy conservation, analysis and classification of the type presented in the preceding sections is a useful starting point, but it does not provide a program for action. We do not feel that there is yet the basis to establish a comprehensive and effective program for overcoming barriers on a national scale. The reasons for this view are first, that there is not sufficient agreement concerning the need for such action; second , that we do not have sufficient information to decide which strategies are most likely to succeed; and third, that our understanding of the nature of barriers is still too limited. From a practical point of view, the problem is not how to formulate the complete program for overcoming barriers, but rather how to initiate action that will set us on the road to this goal.

- Information Programs. Time and again in our field work for this study, and in other work we have conducted, we have encountered lack of information as a barrier to energy conservation. There are engineers who do not know how to design energy efficient systems, architects who do not understand the principles of energy efficient buildings, building operators who do not know how to run buildings efficiently, and homeowners who do not know what conservation measures are cost effective. It seems obvious to us that the nation will have to improve the level of training and understanding for all of these people and many others if it hopes to deal with its energy problems successfully. Without trained professionals and an understanding public, other programs aimed at removing barriers to energy conservation are likely to have little effect.

Increased government support for education and training in energy conservation is a logical, and, one would think, fairly easy way to begin confronting the lack of information barriers. However, current national efforts in conservation education are something of a scandal. These efforts began auspiciously

in 1976 with a Congressional mandate to the Department of Energy to establish energy extension services in each of the fifty states. But, for a variety of reasons, this program was given a low priority within the Department and is now languishing in the care of a few very overworked junior officials. Perhaps the problems of the Energy Extension Service will someday provide the material for an interesting case study in barriers to energy conservation. For the present, we think it is more urgent to find ways to revitalize this program and to initiate others with similar objectives.

• Demonstration Projects. While the criteria proposed in the preceding section can give the policy maker some guidance when evaluating strategies aimed at overcoming barriers, they can hardly guarantee success. In fact, if experience is any guide, most strategies, and especially those that confront the more deeply rooted barriers, will achieve only limited success or will fail completely. What can be done to increase the likelihood that programs to which resources are committed on a national scale will be productive?

One approach is to try out programs on a smaller scale. The pluralistic tradition of American government may offer an opportunity to do this without requiring Federal planners to select perhaps unwilling participants for such demonstrations. State and local governments are likely to propose and attempt a variety of strategies, especially in the light of the recent intensification of energy problems. (This is not entirely speculative; in California, the city of Davis provides a good example of a local government that is willing to undertake such initiatives.) However, this groundbreaking has risks associated with it that may outweigh the likely benefits for a locality. For an untried program, the risks of failure may make local jurisdictions unwilling to underwrite start-up costs. Further, if a program involves novel legislation, a local jurisdiction may find itself entangled in expensive litigation.

This is another case of a misplaced incentives barrier. That is, the benefits of demonstrating that a stragegy is successful (or unsuccessful) are shared by many localities while the costs are borne by only one. If the Federal government could underwrite some of the local risks it would provide a significant encouragement for innovation. This is not easy to do since it is usually difficult to decide what share of the risks it is proper to underwrite and

there is a temptation for the sponsoring agency to intervene in ways which, while they may increase the likelihood of local success, tend to reduce the value of the demonstration. Nevertheless, we think that Federal initiatives aimed at increasing local government experimentation with strategies for overcoming barriers are likely to be of considerable value and ought to be undertaken.

• Research. The most serious difficulty confronting the policy maker in trying to develop strategies for overcoming barriers to energy conservation is the lack of a fundamental understanding of the nature of barriers and of sound and systematic methods for evaluating strategies. For example, while we have pointed to the importance of social norms in shaping energy consumption habits, the understanding of the processes by which such norms evolve is very limited. While we have urged an intensification of conservation information and education efforts, knowledge of the economics of information is still primitive. While we have proposed that the demonstration of strategies for overcoming barriers be encouraged, there is no established methodology for evaluating such demonstrations.

The policy maker can have little hope that he will be able to confront social and institutional barriers to energy conservation with a complete understanding any time in the near future. But this is no reason for delaying the research necessary to provide a greater understanding. We hope that the work we have reported in the preceding pages has made some advance toward this goal, but the efforts of many other researchers from a variety of disciplines must be enlisted before really substantial progress can be made.

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TECHNICAL INFORMATION DEPARTMENT
LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA 94720