

Lasting Impressions: Conservation and the 2001 California Energy Crisis

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ABSTRACT

This paper presents the results of a study of household conservation response to the California energy supply crises during the summer of 2001 and in the post-crisis year of 2002. It draws upon two statewide telephone survey waves, with matched consumption information from customer electricity bills, and weather data from various parts of the state. The analysis explores conservation behavior, energy attitudes, social and housing demographics, and estimated energy savings. We found that the conservation response to the crisis exceeded expectations in the energy policy community, with consumers showing surprising flexibility in their energy demands, and for reasons other than energy prices. While conservation actions (both behavioral and hardware purchase) were reported by a large majority of households, they were also somewhat socially segmented, and the resulting energy savings were not evenly distributed across the population. There was persistence of conservation a year after the crisis, as well as continuing concern by consumers about energy-related issues. As a result of the crisis experience, the routine functioning of the energy system seems to have been "problematized" for many Californians. Some implications of these findings for future energy efficiency and renewable energy policies are considered.

The Problem

Beginning in the summer of 2000, California experienced serious energy supply problems, sharp increases in wholesale (and retail) electricity and natural gas prices, and isolated blackouts. In response to the rapidly worsening electricity situation in California in late 2000, a variety of efforts were undertaken to enhance supply, encourage rapid voluntary reductions in demand, and provide incentives for actions that would result in load reductions. Large-scale conservation marketing campaigns accompanied by financial incentives were directed at residential consumers to encourage both improvements in the efficiency of energy using equipment and changes in behavior, such as using less lighting, turning off unused equipment, reducing the use of cooling energy, shifting loads to off-peak times of day, and preparing for rolling blackouts. In addition, consumers in California also experienced price increases, threats of rolling blackouts, and widespread media coverage of the political turmoil and uncertainty surrounding the energy supply system.

The California Energy Commission (CEC) recognized that the crisis presented a unique opportunity to gather information about conservation decision-making that could ultimately lead to improved policy development, program design and demand forecasting. As a result, the CEC commissioned a detailed evaluation of California consumer response during the summer of 2001 and beyond. The residential portion of that research is reported here. Findings represent a break

from conventional policy thinking and are considered in detail in Lutzenhiser et al. (2003) and summarized in Kunkle et al. (2004)

Consumer Behavior in Traditional Energy Policy Analysis

Conventional energy policy wisdom treats consumer demand for household energy as relatively inflexible. Behavior change related to energy use is seen as rare and often resisted, with post-conservation “snap-back” to be expected. The implications of this view have included a focus on *price policies* (as motivators) and *hardware programs* (to secure efficiency gains without requiring behavior change). For a variety of reasons, the energy situation in California in 2001 provided a unique research opportunity to critically examine this view.

Before considering our findings, it is useful to briefly recognize the fact that several social science disciplines have literatures that are relevant to the problem of understanding conservation behavior. As a result, the findings reported here also have a significant bearing on social science theory — providing support for some views of consumer action and casting doubt upon others. The literature on household energy use and conservation is voluminous and has been carefully reviewed elsewhere (e.g., see Stern and Aronson 1984, Katzev and Johnson 1987, Lutzenhiser 1993, Shove et al. 1998, Lutzenhiser, Harris and Olsen 2002). Suffice it to say that research shows that energy-related consumer behavior is complex and multi-faceted. Data relating energy use to consumer behavior are scarce, making analysis of energy use difficult for both energy users and energy policy analysts. Relatively little of this work has made its way into energy policy discussions, however, and it is useful to consider the evolution of energy efficiency policy in order to understand why.

The Marginal Status of the Consumer in 1980s-1990s Energy Policy

To the degree that energy *conservation* (e.g., using less energy or not using energy or saving energy) has been part of California state policy for the past two decades, the concern has focused on justifying energy non-use from a least-cost utility planning framework — and more recently from interest in reducing environmental impacts from increased energy use. The goal has been to acquire predictable levels of conservation by technological means. From the late 1970s through the 1980s, energy conservation measures aimed to improve the energy efficiency of hardware—devices ranging from refrigerators to light bulbs, from motors to building insulation. The “human factor”—e.g., voluntary conservation, frugal use of energy, curtailment of energy usage during periods of peak demand—was seen as too unpredictable and intractable to be a reliable policy target. In addition, the electoral defeat of Jimmy Carter in 1980 was believed to be due in part to his appeals to the American public for frugal energy use during the 1978 energy crisis (Nye 1998).

Consumer understandings, behaviors, and conservation potentials were not emphasized in energy policy in the 1980s. Rather, policy was dominated by a “resource acquisition” (efficiency as a source of supply) logic. Consumer research was rarely undertaken, and consumer behavior change was not addressed in the marketing of hardware-focused programs and incentives.¹

¹ To be fair, we should point out that the resource acquisition approach favored technology because its effects could be readily measured. This allowed energy efficiency to be considered a resource equivalent to supply side resources. To counter the politically-damaging image of conservation as “sacrifice” in the Carter era, attempts were made to redefine energy conservation as “efficient use of resources,” that is, a way to get an equivalent level of service (no

During the 1990s, a move toward deregulated energy markets led to a retreat of efficiency policy from resource acquisition and a turn toward “market transformation” (MT) approaches, where market actors were encouraged to pursue efficiency for their own self-interested reasons. The shift to an MT-focused energy efficiency policy, particularly in California and the Pacific Northwest caused some renewed interest in behavior. For the most part this involved encouraging suppliers to offer more energy efficient technology and services, and consumers to adopt those technologies and services. The principle of an “exit strategy” by market interveners assumed that there would be long-term changes in markets and presumably in the behavior of market actors. However, an understanding of these relationships was poorly established, and in many ways MT thinking was rooted in the traditional resource acquisition framework. Deregulation and the uncertainty around the potential for deregulation resulted in a significant decline in energy efficiency programs during the late 1990’s leading up to the energy crisis.

Enter the Crisis: The Emergence of the Consumer as a Significant Party

When the 2000-2001 energy crisis overtook California, the energy conservation policy framework focused on marginal improvements in hardware efficiency and a hope that competitive energy supply markets might encourage efficiency investment. The concrete policy options available to state leaders in 2000 included accelerating the purchase of hardware (lighting, motors, refrigeration, and cooling systems) and improving large energy users’ abilities to track energy use and market prices via interval (“real time”) meters and supporting communications hardware/software. Both of these avenues were aggressively pursued by California energy agencies.

However, the magnitude of the crisis required exceptional action. So the California Legislature and executive branch went beyond the conventional policy frame to *appeal directly to energy consumers* via a novel “Flex Your Power” campaign. The campaign used a combination of media messages, appeals from public officials, executive orders to state agencies, news stories, and direct contacts with major corporations, local governments and other large energy users, to ask for voluntary conservation action of *any sort*—action that included *changes in behavior*, such as using less lighting, turning off unused equipment, reducing the use of cooling energy, shifting loads to off-peak times of day, and preparing for rolling blackouts (Bender, et al. 2002). The results were both surprising and welcome.

Data and Methods

The data used in this analysis were acquired from California consumers and major utility companies. Two telephone surveys were conducted, one immediately following the crisis and one a year later. The first telephone survey of 1,666 randomly selected residential electricity consumers was conducted during the months of September and October of 2001. The survey sample was stratified by utility territory, with interviews of between 200 and 400 households conducted in each of the five major California utility service territories. Many of the questions posed to consumers were open-ended, allowing them to report actions, motivations, attitudes,

sacrifice) with less energy use. In the resource acquisition approach, behavioral study was limited to possible degradation of performance of energy efficiency technology (e.g., when persons were not willing to adopt the technology, or when they did not operate or maintain it properly).

and opinions in their own terms. The second survey was conducted from late October 2002 to early January 2003, contacting 1482 households participating in the first survey who had agreed we could call them back. A total of 815 surveys were completed in this second wave.

Data were also collected on household energy use before, during and after the 2000-2001 crisis from larger random samples of residential utility customers, along with weather data from key weather stations in the various utility territories. Analysis of both survey and large sample consumption data are reported here.

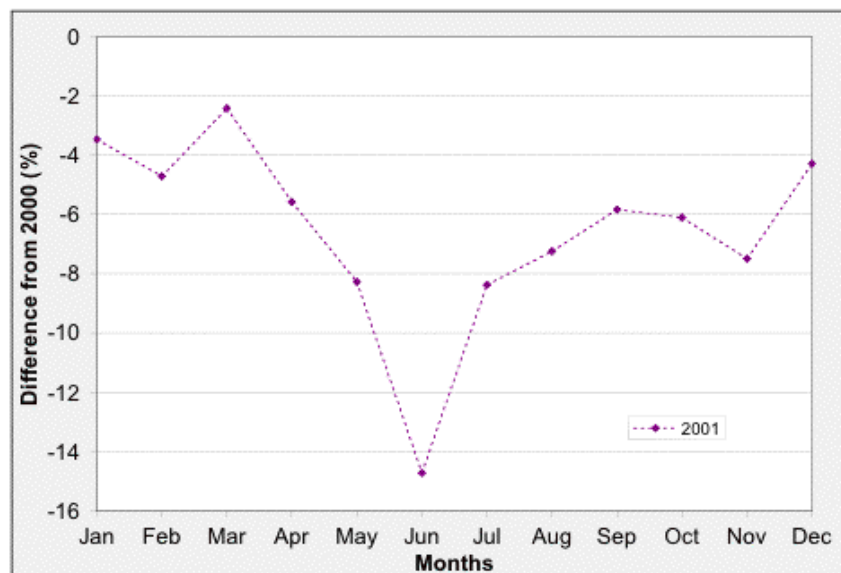
Household Response to the 2001 Energy Crisis

The following key findings describe how households responded to the 2001 energy crisis, what energy conservation behaviors households were still performing in the year following the crisis, and what we learned about household energy behavior that have some potential implications for energy policy.

Unexpected Consumer Ability to Conserve Added Flexibility to the Energy Market

During the summer of 2001 changes in energy use that resulted from Californians' concerns and reactions to the energy crisis were striking. In 2001 Californians reduced electricity usage by almost 7 percent and peak monthly summer demand by 8 to 14 percent, compared to 2000. Figure 1 shows the reduction in monthly energy use for 2001 relative to 2000. This is based on recent energy use data from the California Independent System Operator (CA ISO) and corrects for the effect of weather and changes in the economy (California Energy Commission 2003a). Widespread energy shortages and rolling blackouts were forecast for summer 2001 in California. At least in part due to conservation response, instead there were no rolling blackouts or stage 3 alerts during summer 2001, and just two stage 1 and two stage 2 alerts. Conservation contributed to this positive outcome. Reductions in electricity demand also helped avoid more serious electric market instability and price volatility.

Figure 1. Monthly Demand Reduction in 2001 Relative to 2000



Additional weather-controlled analyses were conducted using data from the Quarterly Energy Fuels Report and samples of electricity bills for 5,000 households in each of the 5 major IOU territories. Results, both at the utility and at the household level, show that changes in consumption for 2001 compared to 2000 were not weather-driven, but reflected changes in behavior. While too lengthy to be discussed here, details of the analysis and findings can also be found in Lutzenhiser et al. (2003).

Actions Were Widespread Across Households

More than 75 percent of the households participating in the survey reported taking one or more conservation actions. More than half of the households (58.5 percent) took two or more actions, with 2.4 being the mean number reported. Using less lighting was the most common response (65.5 percent). In all, 9.6 percent of households reported using no air conditioning at all, and 48.5 percent took other conservation actions related to cooling or heating. Almost 45 percent (44.7 percent) reported at least 1 change in heating or cooling behavior. Other actions that were reported in the 20 to 30 percent range of households include small equipment behaviors such as turning off equipment when not in use, using compact fluorescent or low energy bulbs, and shifting energy use to off-peak hours. Relatively small proportions reported making major energy efficiency investments in their homes (shell improvements) or investing in energy efficient appliances.

Changes in Behavior Rather than Hardware Efficiency Improvements Accounted for Most of the 2001 Reduction

Hardware solutions were heavily promoted both during and after the 2001 crisis period, however demand reductions were largely due to changes in behavior. Behavioral actions (e.g., turning off lights, unplugging equipment, using less AC, etc.) accounted for 84 percent of all of the actions reported. This is not surprising, since these can be made on short notice. Among the less frequent actions involving hardware purchases and investments the installation of compact fluorescent lamps (CFLs) and other low energy bulbs was the most common. Purchasing and installing new light bulbs is by far the easiest hardware action for households to take. Opportunities to make larger energy efficiency investments in the home or purchase energy efficient appliances are quite limited for persons with low and/or fixed incomes, and those living in apartments or rental homes.

According to their self-reports, households relied primarily on past experience and common sense (likely with some prompting from *Flex Your Power* advertising) to choose the conservation actions they pursued. Many persons, regardless of their present circumstances, may recall frugal use of energy (and other resources) in earlier periods and previous shortages.

Clustering and Segmentation of Actions

About a fifth of households (18 percent) reported taking a single conservation action, 24 percent reported doing two different things to conserve energy, and 30 percent reported doing three or more—28 percent reported taking no actions in the 2001 survey. Because two or more actions were taken by most conserving households, a logical question is whether some of these tended to accompany others. A related question is whether households with certain types of demographic characteristics were inclined to take particular conservation actions.

While there was no evidence that certain types of conservation actions were highly correlated with others, there was a set of core behaviors (turning off lighting, turning off small equipment, and other heating or cooling behaviors) that often appeared in pairs and sometimes altogether. These behaviors represent the most basic type of conservation actions possible. They can be easily adopted and were fairly widespread.

The *socio-demographic segmentation* of actions we observed in the first year survey often reflected the ability of households to take certain conservation actions. For example, owners performed more conservations actions than renters in all categories *except* for the ones in which renters had a nearly equal capacity to act: e.g., shutting off unused lights and shutting off small household equipment. Apartment dwellers, who often have the most constraints on their ability to make conservation investments, were more likely, then, to report purchases of energy efficient *small* appliances and lights.

Reductions in Consumption were not evenly Distributed across the Population

Three levels of analysis have been pursued—at the system level (QFER data), by utility territory, and by household. Two system-level analyses were mentioned above. We also conducted two additional analyses to see if differences in savings could be detected at the utility and household levels. To this end, electricity consumption data from 1999-2001 for 5,000 customers from each utility (Los Angeles Department of Water and Power, Pacific Gas & Electric, Southern California Edison, San Diego Gas & Electric, and Sacramento Municipal Utility District) were collected and analyzed, along with cooling and heating degree day data (to control for differences in the weather). We found that the distribution of change in customer reactions to cooling degree-days in summer 2001 was highly varied—not everyone reacted to the crisis by saving at similar levels. This suggests that reductions in energy use were somewhat concentrated, with a smaller subset of the population evidencing larger changes than the rest of the population.

While there is greater uncertainty about the actual magnitude of any reduction in electricity use (controlling for weather differences) at the household-level, if any “super savers” (e.g., 20 percent+ savers) exist they will show themselves as a lump (technically, a “skew”) to one side of the average of a distribution of savings estimates. So we performed an analysis that allowed us to measure the skewness of each utility’s distribution of savings. While PG&E, SCE, and SMUD analyses all showed some evidence of super-savers (indicated by a negative median skew), only in SCE and SMUD do the super-savers have a strong enough presence to suggest their existence with great confidence (e.g., at the .02 level). The lack of evidence in the SDG&E territory is likely because of the earlier onset of the electricity crisis in that area. While PG&E territory shows some evidence of super-savers, it is so climatically diverse that under the best of circumstances it would be difficult to detect them by this test. In short, these results suggest that while most of the population showed some savings in a household-level analysis, there was also a smaller cadre of super-savers that altered their reaction to hot weather much more than the rest of the population, especially in the SMUD service area. The uneven distribution of savings is important and interesting finding, since large percentages of people reported taking action(s), but apparently many of these may not have saved much.

Consumer Willingness to Turn Off Air Conditioners Likely Made a Large Contribution to Lower Consumption

It is important to note that, with the exception of “turning off lights,” cooling-related conservation behaviors were the most frequent reported. These include not using air conditioning at all, plus other (non-AC-related) heating/cooling behaviors, most of which involve using less air conditioning. The actual verbatim responses in this category describe actions such as “draw window shades or curtains during the day,” “turn thermostat off when I’m away,” “don’t use the AC,” “use the air conditioner less often,” “open windows at night,” “open windows in early morning,” and “close off part of home to use less cooling.” The results of the survey show that among households with central AC, 36 percent reported using less or no air conditioning. And 29 percent of room AC owners reported using less or no air conditioning. Not only were air conditioning conservation behaviors a commonly reported conservation approach, but they may well deliver the greatest energy and peak demand benefits. Cooling accounts for 35.5 percent of Peak (MW) and 7.4 percent of annual residential consumption (CEC 2003b).

Consumers Were Motivated by More than Just Cost

Although consumers were certainly interested in containing costs, a common expectation (particularly by those outside of California) has been that conservation action will not occur without price increases. During the 2001 energy crisis, actual price increases were sporadic, unevenly applied, and often came long after the conservation action was initiated. For some people, behavioral changes were not induced by cost concerns, but rather by civic concerns and altruistic motives. Consumers reported a number of reasons why they changed their energy use, ranging from what we might call self-interest (keep my energy bill down) to civic responsibility (doing my part, avoiding blackouts) and altruistic motives (protecting the environment, using energy resources wisely). Many respondents reported holding more than one of these views. Qualifying for a utility rebate was the least common motivation, and available utility rebates were not relevant to most of the actions consumers took. The majority of those taking no conservation actions at all indicated that this was because they felt that their energy use was already low.

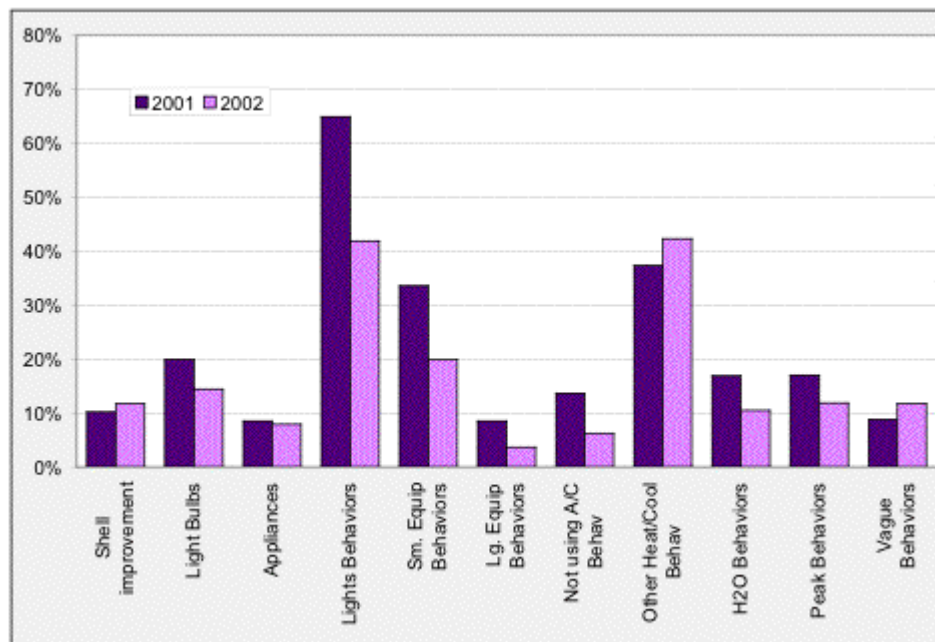
One Year After the Crisis: Voluntary Conservation Continued, but Produced Less Savings

What were the lasting effects of the 2001 energy crisis on household energy behavior? Conventional wisdom would suggest that continuation of conservation behaviors in 2002 would be heavily influenced by household perceptions of a continuing electricity crisis or significant energy problems, along with price sensitivity to retail electricity rate trends. Given the apparent subsiding of the energy crisis, one might expect a decline in electricity demand reduction. The data support this idea to some extent, but there is still significant evidence of continuing conservation behavior. Voluntary conservation did continue to produce energy savings, with about one half of the 2001 crisis savings persisting in 2002, controlling for differences in weather between the two years.

Households Continued Conservation Behaviors

We found that 90 percent of the households that had reported taking one or more conservation actions in the summer of 2001 were still pursuing at least one conservation action (see Figure 2). There was a decrease in the number of actions for all but two of the eight behavioral-type actions. There was an increase in heating/cooling conservation behaviors other than non-AC use. For hardware-type actions, similar percentages of households pursued site improvement and appliance purchases in 2002, but there was about a 25 percent decline in reported light bulb conservation actions.

Figure 2. Percent of Conserving Households Reporting Various Conservation Actions in 2001 and 2002



The most common reasons given for discontinuing actions included: “Just easy to slip back into old ways” (46 percent); “No need after summer” (34 percent); “With crisis gone, no more need” (12 percent); “Security reasons” (7 percent); and “Too difficult or inconvenient” (2 percent).

Nineteen percent of the households responding to the 2002 survey had reported not taking any conservation actions in the 2001 survey. As noted in their open-ended remarks in the 2001 survey, the majority of these indicated the reason was their already-low energy use. In the 2002 survey, however, when these households were asked if they had taken any *new* actions in 2002 to conserve energy, about a third indicated that they had. Primary actions included buying CFLs and other low-energy bulbs and using less lighting.

Consumers Expressed Continued Concerns about Energy and Positive Attitudes Towards Conservation

We asked households in both the 2001 and 2002 surveys “how much have you been thinking about energy problems in the state of California and how they affect you, your family, or friends.” As expected, the level of concern about energy declined, but the change was not dramatic. While those saying they were thinking about energy a lot declined from 48 to 31 percent, there was only a small increase in the number saying that they were not thinking about energy at all. This suggests that energy is still an issue for many Californians—a conclusion that is reinforced by responses to a series of attitudinal questions about energy.

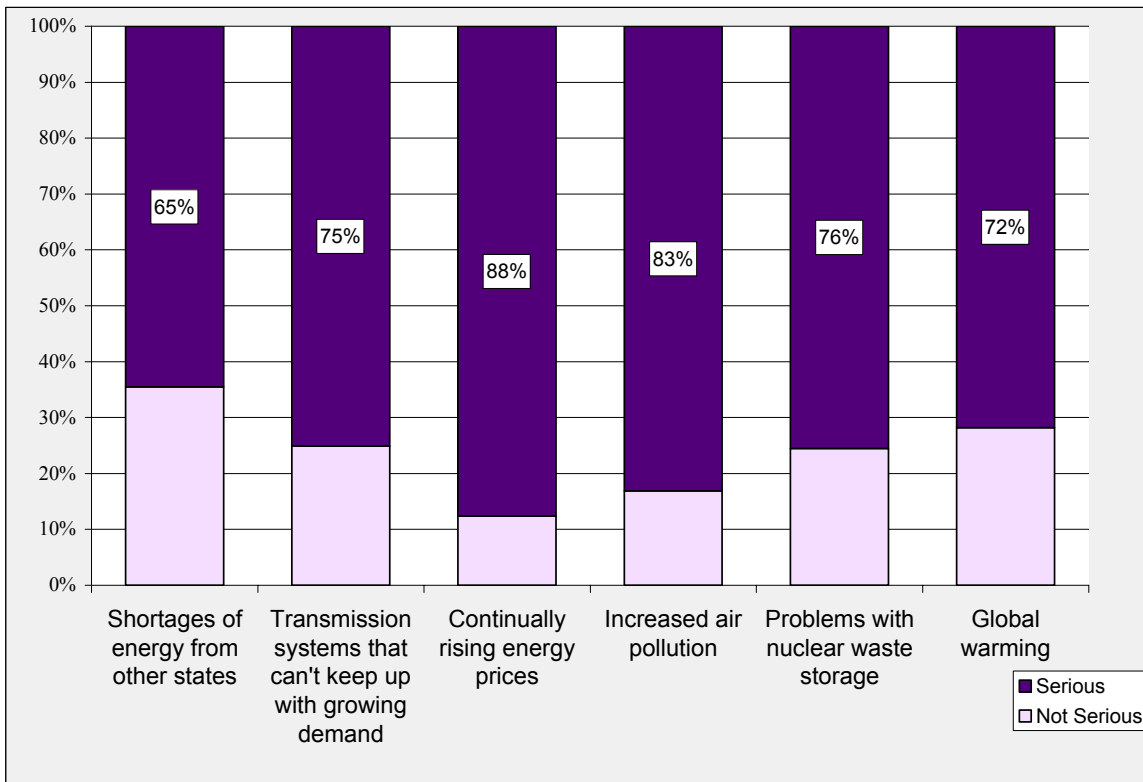
Consumer attitudes about energy conservation were explored in greater depth in the 2002 survey than they could be in the earlier survey (which focused more directly on conservation actions and motivations). We wondered if consumers might have become skeptical by 2002 about energy conservation—perhaps signaling a post-conservation “snap-back.” To the contrary, their responses seem to indicate that residential consumers in California continue to believe that energy issues are real and that energy conservation is important. In all cases, very large majorities (80 to 93 percent) offered pro-conservation responses that should have significant program and policy implications.

The Energy System has been “Problematized”

We believe that the events in California in 2000-2002 have called into question any myths about consumer “backlash” that have supported an “off-limits” policy regarding voluntary conservation and lifestyle change. And while it may be true that Americans during the first crises of the 1970’s did not want to hear that the energy system was vulnerable (and that, consequently, the “American way of life” was not as uncomplicated as had been assumed), a lot has taken place in the ensuing 20+ years. It is our belief that, in California at least, the modern energy system has now been “problematized”—entering the realm of other, now commonplace, problems of modernity such as the clogged and dangerous highway system, air pollution and health risk, questions about the safety of food supplies, rapid spread of exotic diseases, environmental degradation and ecosystem decline, crime and crowding, and so on. In the consciousness of the California energy consumer, the energy system can no longer be taken for granted, and it may actually be understood to have potentially serious problems, as part of other large-scale systems with serious problems.

Figure 3 presents the results of a series of survey questions about the concern for energy system-related problems. A clear majority of Californians felt that all were serious and would continue to be serious in the future. These included shortages of energy imports, transmission system limitations, continually rising costs of energy, increased pollution, nuclear waste storage, and global warming.

Figure 3. Household Perspectives on the Seriousness of Future Energy Problems



Rather than resignation to the situation, another series of questions about energy policy options suggests strong support for proactive efforts by government agencies and utilities to try to address these problems through support for continued energy conservation efforts by households, businesses, and governments. Fifty-nine percent of households surveyed said that it is “very important” to continue government sponsored energy conservation programs and 73% agreed that the expansion of renewable sources of energy like wind and solar is “very important”. In terms of energy efficiency, 75% felt that it is “very important” to encourage greater energy efficiency in households while 79% said improving the energy efficiency of business is “very important.”

Conclusions

Our findings indicate that widespread energy conservation is possible through voluntary change in household energy behavior when consumers are convinced that there is a relevant problem/crisis that they can help solve. But in order to use this knowledge to improve energy policies and programs, we need to know more about consumer behavior, choice and understandings. The research reported here, as well as the existing literature, demonstrate that these are complex, intricate and dynamic processes that are not well understood. The need for serious research in this area has been noted repeatedly over the course of the past two decades (e.g., Stern and Aronson 1984, Lutzenhiser 1993, Shove et al. 1998), with limited effect.

There are a variety of challenges involved in the study of household energy use and conservation behavior that require the use of innovative data collection approaches and analytic

techniques. However, this allowed us to discover that conservation was widely performed across a highly diverse population, but with significant differences between households in their abilities to actually save large amounts of energy. These findings point to a receptive population and a large as-yet-untapped reservoir of energy savings in the residential sector. The next task is to develop better understandings of variations in patterns of household energy use, of how people manage their energy (and energy using/saving approaches), of how people modify their habits and strategies in response to different sorts of stimuli (social concern, self-interest, price, policy, media messages), and how all of these may differ across socio-demographic groups.

References

- Bender, S., M. Moezzi, M. Gossard, and L. Lutzenhiser. 2002. "Using Mass Media to Influence Energy Consumption Behavior: California's 2001 *Flex Your Power* Campaign as a Case Study" *Proceedings, ACEEE 2002 Summer Study on Energy Efficiency in Buildings*. 8.15-8.28. Washington, D.C.: American Council for an Energy-Efficient Economy.
- CEC (California Energy Commission). 2003a. *Revised Energy Conservation Impact Assessment*. Sacramento, Calif: California Energy Commission.
- CEC (California Energy Commission). 2003b. *California Energy Demand 2003-2013 Forecast*. February 11, 2003. Staff draft report #100-03-02SD. Sacramento, Calif.: California Energy Commission.
- Katzev, R. and T. Johnson. 1987. *Promoting Energy Conservation: An Analysis of Behavioral Research*. Boulder, Colo: Westview Press.
- Kunkle, R., L. Lutzenhiser, S. Sawyer, S. Bender. 2004. "New Imagery and New Directions for Residential Sector Energy Policies." *Proceedings of the ACEEE 2004 Summer Study on Energy Efficiency in Buildings*, in this volume. Washington, D.C.: American Council for an Energy-Efficient Economy.
- Lutzenhiser, L. 1993. "Social and Behavioral Aspects of Energy Use." *Annual Review of Energy and the Environment* 18:247-89.
- Lutzenhiser, L., M. H. Gossard, S. Bender. 2002. "Crisis in Paradise: Understanding the Household Conservation: Response to California's 2001 Energy Crisis." *Proceedings of the ACEEE 2002 Summer Study on Energy Efficiency in Buildings*, 8.153-8.166. Washington, D.C.: American Council for an Energy-Efficient Economy.
- Lutzenhiser, L., C. Harris, and M. Olsen. 2001. "Energy, Society and Environment" pp. 222-271 in Riley Dunlap and William Michaelson, eds. *Handbook of Environmental Sociology* Westport, Conn: Greenwood Press.
- Lutzenhiser, L., R. Kunkle, J. Woods, and S. Lutzenhiser. 2003. "Conservation Behavior by Residential Consumers During and After the 2000-2001 California Energy Crisis." pp.

146-200 *Public Interest Energy Strategies Report* Pub. #100-03-012f, Sacramento, Calif.: California Energy Commission.

Nye, D. 1998. *Consuming Power: A Social History of American Energies*. Cambridge, MA: MIT Press.

Shove, E., L. Lutzenhiser, S. Guy, B. Hackett, and H. Wilhite. 1998. "Energy and Social Systems" pp. 201-234 in Steve Rayner and Elizabeth Malon, eds. *Human Choice and Climate Change* Columbus, Ohio: Battelle Press.

Stern, P. and Aronson, E. 1984. *Energy Use: The Human Dimension*. New York: W.H. Freeman.