

# Why Social and Behavioral Science Research is Critical To Meeting California's Climate Challenges

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# Topics for Today

- California's ambitious climate goals
- The role of social science in reaching them
- What we have learned
  - Examples from residential energy use
- Research priorities from the National Academies
- Research priorities for California

# California's Ambitious Goals

## Reduce GHG emissions to:

- 2000 levels by 2010
- 1990 levels by 2020
- 80% below 1990 levels by 2050

## These are very ambitious goals.

- Achieving them would be a major contribution to global goals, but this will not be easy to accomplish (especially with population and economic growth)
- We can't rely on projections that assume that policies will work as intended. They often don't.

# Can the goals be met?

- We hope so, but don't know.
- There is little hope of achieving such ambitious goals without understanding why policies fall short and how to improve their effectiveness.
- This is where social and behavioral science come in.

# Main social science questions for meeting the climate challenges:

- How much change can be expected from each policy option (in the real world, with real energy consumers, markets, and organizations)?
- How can you choose and design policies for maximum effect?

*Social science research can address these questions directly, and also by building basic understanding of energy use and users and of the many factors that affect their behavior.*

# What do we know?

- Much research and many policy interventions to promote efficiency and conservation between the mid-'70s and mid-'80s, when energy use was a major policy concern
- Much less research over the past 2 decades
- Policies have had highly varied effects
- The most effective ones demonstrate the potential for improvement in the others
- Unfortunately, policies are often less effective than expected
- Much is known about why policies have fallen short and why their effects are variable
- Much is known about ways to design interventions for much greater effect

# Some Illustrative Examples: A Look at Energy Use in Residential Buildings

- Investments in energy-efficient appliances
- Household responses to financial incentive programs
- Some other policy examples

# Example: Investments in Energy Efficiency in Home Appliances

- *Premise:* If the investment in a more energy-efficient appliance is paid off at a better-than-market rate of return, people will buy it
- *Hypothesis:* The “implicit discount rate” for energy efficiency in appliances—the rate of return from efficiency that would make purchasers indifferent between a more- and less-efficient model—should be no more than about 10%.

# Results

**Table 1.** Implicit discount rates calculated from data on purchases of household appliances.

| Appliance                | 1972 | 1978 | 1980 |
|--------------------------|------|------|------|
| Gas central space heater | 39   | 51   | 56   |
| Oil central space heater | 52   | 78   | 127  |
| Room air conditioner     | 20   | 22   | 19   |
| Central air conditioner  | 19   | 25   | 18   |
| Electric water heater    | 587  | 825  | 816  |
| Gas water heater         | 91   | 146  | 166  |
| Refrigerator             | 105  | 96   | 78   |
| Freezer                  | 379  | 307  | 270  |

Source: Ruderman, H., Levine, M. D., and McMahon, J. E., "The Behavior of the Market for Energy Efficiency in Residential Appliances Including Heating and Cooling Equipment," *The Energy Journal*, 7 (1986) in press.

# Conclusions

- Consumers seem to demand much greater financial returns from investments in energy efficiency than from bank accounts, stocks, or other investments
- Much less investment took place in energy efficiency than would be economically rational.

# Why?

## Some possible explanations

- Consumers are stupid or irrational
- Consumers don't know what their returns will be from efficiency, don't trust claims about the returns, or lack the time or know-how to get trustworthy estimates
- Consumers are influenced by marketing of less-efficient models
- Households treat appliance purchases not as investments but perhaps as upgrades of lifestyle or as emergency responses
- Households don't actually purchase the appliances (they are purchased by builders, contractors, or repair personnel from wholesalers, and retailers, none of whom get the benefits from energy savings)

# Implications

- All these explanations but the first are plausible
- You need research to get the right explanation
- Knowing which explanations matter most allows policy makers to select promising interventions
- Different explanations point to different targets of intervention (better information, improved trust in information, increased convenience, interventions in market structures, efforts to influence vendors)

# Example: Responses to Financial Incentives for Home Energy Efficiency

## *Bonneville Power Administration*

### *Interim Residential Weatherization Program*

- Administered by 7 utility companies
- Grant to homeowners averaging 93% of cost of measures installed after energy audit

*(1982-83 data)*

# Results

| Utility        | Audits/home | Weatherized/audit | Weatherized/home |
|----------------|-------------|-------------------|------------------|
| A              | 11.8        | 61.0              | 7.3              |
| B              | 14.2        | 82.9              | 11.8             |
| C              | 23.2        | 57.9              | 13.3             |
| D              | 23.1        | 83.4              | 19.3             |
| E              | 1.6         | 90.9              | 1.4              |
| F              | 12.1        | 83.7              | 10.2             |
| G              | 2.4         | 77.1              | 1.9              |
| Average        | 9.1         | 59.6              | 5.3              |
| Highest/lowest | 14.5:1      | 1.6:1             | 13.8:1           |

*Source: Lerman and Bronfman (1984)*

# Conclusions

Average response was amazingly meager to offers of nearly-free energy-saving home improvements

- Huge variability in responses across utilities offering identical incentives (more than tenfold variation in each program)
- With this very strong incentive, variation was mainly due to getting homes audited

Overall conclusions: Program success depends on people and organizations; getting homeowners' attention to the program is a major part of this

# Some Other Policy Examples

## The Residential Conservation Service

- National program of the early 1980s that offered free home energy audits and recommendations for retrofits
- Penetration varied greatly between neighboring states:

|          |          |          |
|----------|----------|----------|
| VT – 12% | WI – 19% | WA – 20% |
| NH - <1% | MN – 4%  | OR – 8%  |
- **Possible implication:** *Marketing of programs accounts for much of this large variation.*

# Financial Incentives in the USA Versus Other Countries

- **3 grant programs in USA**

  - Median subsidy – 77% of retrofit cost

  - Median penetration – 4%/yr

- **5 grant programs in CA, DK, UK, NL**

  - Median subsidy – 50% of retrofit cost

  - Median penetration – 8%/yr

# Possible implication

One striking difference:

- All the US programs required home energy audits before retrofits
- In the foreign programs, householders only had to purchase recommended goods and services and send a receipt to the government

*Convenience* may have made a large difference in the penetration of these programs.

# Conclusions From the Research on Households

These and numerous other studies point to these conclusions (among others):

- **Multiple causes:** Energy use depends on, and behavior change is limited by multiple factors (e.g., available technology, knowledge, money, convenience, trust in information, personal situations and capabilities, market factors)
- **Limiting factors vary** with the household and its situation, and over time
- **Limiting factors affect each other**

# Therefore...

## the most effective policies

- **Address multiple barriers** to behavioral change,
- **Combine forms of influence** (information, persuasion, financial incentives)
- **Understand behavior from the household's perspective** and do not presume motives or abilities
- Recognize that household **behavior is often constrained by factors beyond the household's control** (e.g., the practices of repair personnel, manufacturers, wholesalers)
- **Monitor programs continually** to be able to adjust them as needed

# Research Priorities from the National Academies

The National Academies have long recognized the importance of social and behavioral science research in energy policy

## Energy Crisis Era

Committee on the Behavioral and Social Aspects of Energy Consumption and Production (1980-1985)

- *Energy Use: The Human Dimension* (1984)
- *Improving Energy Demand Analysis* (1984)
- *Energy Efficiency in Buildings: Behavioral Issues* (1985)

## Global Change Era

### *Standing Committee on the Human Dimensions of Global Change (1989- )*

- *Global Environmental Change: Understanding the Human Dimensions (1992)*
- *Science Priorities for the Human Dimensions of Global Change (1994)*
- *Environmentally Significant Consumption: Research Directions (1997)*
- *Human Dimensions of Global Environmental Change: Research Pathways for the Next Decade (1999)*
- *New Tools for Environmental Protection: Education, Information, and Voluntary Measures (2002)*
- ***Decision Making for the Environment: Social and Behavioral Science Research Priorities (2005)***

## Other Relevant NRC Reports

- *Grand Challenges in Environmental Sciences* (2001) – identified the need to understand governance of environmental resources as a grand challenge
- *Benefits of DOE R&D on Energy Efficiency and Fossil Energy* (2001) – reviewed DOE investments in energy technology R&D and found that some investment strategies were more often productive of major economic returns than others
- *Implementing Climate and Global Change Research: A Review of the U.S. Climate Change Science Program Strategic Plan* (2004) – identified need for the program to significantly increase investment in research on human dimensions, mitigation, adaptation, and economics

# ***Decision Making for the Environment: Social and Behavioral Science Research Priorities (2005)***

This latest NRC effort to identify research priorities includes many research areas directly germane to energy and to meeting climate challenges.

The study recommended 5 priority areas:

1. **Environmentally significant individual behavior**
2. **The environment in business decision making**
3. **Institutions for environmental governance**
4. **Improving environmental decision processes**
5. **Decision-relevant science for evidence-based environmental policy**

# Environmentally Significant Individual Behavior

Research is recommended on:

- *Indicators of environmentally significant consumption* (measures of environmental impact that can be linked to household choices)
- *Information transmission systems* (ways information sources and links among them affect the ability of households to get accurate information about the environmental implications of their choices)
- *Integration of information with other policy instruments* (research on the joint effects of information and other policy instruments in particular behavioral contexts, such as travel mode choice and home investment in energy efficiency)
- *Fundamental understanding of consumer choice and constraint* (research on how personal factors such as values, attitudes, and skills, combine with contextual factors such as economic costs, properties of the built environment, and government policies to influence energy using behavior)

# The Environment in Business

## Decision Making

This area has been seriously understudied. Among the highly promising research directions are:

- *Economic performance and competitive advantage* (e.g., when does it pay to be “green”?)
- *Effects of demand on environmental performance* (under what conditions does customer demand drive firms’ environmental performance?)
- *Effects of supply chains and production networks* (e.g., when do dominant businesses affect environmental performance throughout their supply chains?)
- *Environmental accounting and disclosure practices* (e.g., how can firms’ environmental performance be measured more accurately?)
- *Government policy influences on business decision making* (e.g., how can government policies be designed to create effective incentives for green innovation?)

# Institutions for Environmental Governance

No one policy strategy (e.g., regulation, market-based governance, voluntary action) works best in all situations. The research need is to find the arrangement that is most appropriate for particular governance problems.

- *Address strategies for adaptive governance in changing situations as with climate*
- *Address ways to design context-specific property rules*
- *Develop institutional forms that connect scales of social organization*
- *Test ways to build legitimacy and trust in managing complex environmental problems*

# Improving Environmental Decision Processes

Better environmental decisions require better understanding of how to integrate environmental science and understanding of human-environment interactions within decision processes that are judged credible and relevant by those affected

The study recommends three research components:

- *Developing criteria of decision quality* for environmental decisions
- *Developing and testing formal tools for structuring decisions in the face of environmental change*
- *Creating effective processes that combine scientific analysis with broad public deliberation*

# Decision-relevant Science for Evidence-based Environmental Policy

The study recommends four major research activities:

- *Improving indicators of human-environment interactions* that include both environmental states (e.g., GHG emissions) and relevant human activities, by different kinds of actors at different scales, to allow better understanding of which activities produce which changes in environmental conditions
- *Environmental policy evaluation*
- *Improving environmental forecasting*, including analysis of human behaviors such as those that drive energy demand
- *Determining distributional impacts of environmental changes*

# **Social and Behavioral Energy Research for California**