Behavior, Energy, and Climate Change:
Policy Directions, Program Innovations, and Research Paths

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FOREWORD: THE IMPORTANCE OF BEHAVIOR

By the end of this year, the United States will have expanded its economic output by nearly 65% since 1990. Likewise, per capita incomes will have grown by 35%. At the same time, however, the demand for energy and power resources will have grown by only 23%. This decoupling of economic growth and energy consumption is a function of increased energy productivity; in effect, we have increased our ability to generate more energy-related services from each unit of energy consumed. Many would attribute this productivity gain to more productive investments in technology. Indeed, the evidence suggests this to be a significant driver of such improvements. Yet the evidence also suggests an amazing variety of behavioral influences that also contribute to this success story — behaviors that drive new innovations and behaviors that change patterns of technology adoption and energy consumption.

Past analyses by the American Council for an Energy-Efficient Economy (ACEEE), and by well-known researchers like Paul Stern, Gerald Gardner, and others, suggest that understanding and shaping behaviors can provide a significant boost in the more efficient use of all energy resources. (See Gardner and Stern 2008 and Laitner et al. 2009.) Indeed, internal discussions within ACEEE indicate that "the behavioral resource" might provide a 25% efficiency gain (possibly more) above normal productivity improvements — should we choose to understand and develop that resource. In this respect, policymakers and researchers increasingly recognize the importance of addressing behavioral change to reduce costly energy production and consumption and carbon emissions as most energy-efficient technologies require proper human interaction to achieve their promised savings.

One notable example of the growing interest in the topic of behavioral change was the unexpectedly large turnout at the first annual Behavior, Energy and Climate Change (BECC) Conference convened last November in Sacramento, California. Convened jointly by ACEEE, the California Institute for Energy and the Environment, and the Precourt Institute for Energy Efficiency, the organization of the 2007 inaugural BECC Conference initially planned for approximately 150 participants. However, the conference ended up drawing more that 550 people, whose excitement was palpable. Moreover, registration for the 2008 BECC symposium is likely to exceed 700 registrants. (For an immediate update of this now annual event, see http://www.BECCconference.org.) However, what is especially exciting about this event is not so much the number of participants: rather, it is the information generated by the many presentations and discussions catalyzed by this event.

ACEEE sociologist Dr. Karen Ehrhardt-Martinez draws from both the proceedings of the 2007 BECC Conference and the significant literature to lay the groundwork for a more comprehensive understanding of behavior, energy and climate change. She does so in two ways. First, she provides an initial discussion of some of the more important analytical frameworks and core theories related to behavioral change. Second, she identifies some of the most prominent topics and themes that emerged during that conference. As she notes, "of particular importance in both of these efforts is the ability to move beyond simple economic models of human behavior to develop a more complete understanding of behavior that recognizes the social, cultural, political, and moral dimensions of human actions." With this report, she provides us with a valuable resource that can become a highly useful starting point for future research on this critically important topic.

John A. "Skip" Laitner, Director, Economic Analysis
American Council for an Energy-Efficient Economy

ACKNOWLEDGMENTS

This paper would not have been possible without the feedback, financial support, and commitment of many individuals involved in the design, development, and general success of the Behavior, Energy and Climate Change Conference. First, I must thank all of the members of the BECC Advisory Committee as well as all of the organizations who generously sponsored this first ever conference. Without your advice and financial support, this conference could not have been the grand success that it was. (The advisory committee and a full list of sponsors are provided in Appendix C.) Second, I would like to thank the three co-convening organization who agreed to share the risks associated with the development of a brand new conference. In particular, I would like to thank Steve Nadel, Bill Prindle, and Skip Laitner of the American Council for an Energy-Efficient Economy (ACEEE), Carl Blumstein of the California Institute for Energy and Environment (CIEE), and Jim Sweeney of the Precourt Institute for Energy Efficiency (PIEE) for recognizing the importance of behavior in the energy and climate equation. Without the support of these individuals, the BECC Conference may never have become more than a good idea. I would also like to thank Tammy Goodall (PIEE), Glee Murray (ACEEE), Rebecca Lunetta (ACEEE), and Karen Sharp (CIEE) for their oversight of all of the logistics and details associated with conference registrations, hotel accommodations, food, equipment, and the many other details that are required to put together a conference of this size.

I also owe a big debt of gratitude to the many students who volunteered their time and skills to attend the conference sessions and take copious notes, without which I would have been unable to put together such a thorough report to reveal core conference insights. (Student notetakers are listed in Appendix C.)

Clearly, the conference would not have been possible without the hard work of the many people who volunteered to organize the many conference sessions. Session organizers actively participated in many hours of session planning. They were responsible for communicating with speakers, and coordinating presentations and presentation materials. In addition, it is important to recognize that the many presenters provided the source of the majority of ideas presented in this report. To them and their continued work on behavior, energy, and climate change issues, we all owe a huge debt of gratitude. I hope I was successful in accurately capturing your ideas as they were expressed through your conference presentations.

My sincere and heart-felt appreciation also goes to Paul Stern, Rick Diamond, and Sharyn Barata for going above and beyond the call of duty in supplying special insights, investing their personal time and energy, and providing an abundance of support throughout the planning process. These individuals dedicated an immense amount of time and effort in turning the vision into a reality. Without them, the BECC Conference wouldn't have been the success that it was.

Finally, I would like to recognize the leadership, help, and support of Linda Schuck (Conference Chair), and Carrie Armel and Loren Lutzenhiser (Conference Co-Chairs), and thank them for the immeasurable level of dedication and effort that they invested in the realization of the Behavior, Energy and Climate Change Conference.

EXECUTIVE SUMMARY

The United States can reap a wealth of cost-effective energy savings and reduce our contribution to global greenhouse gas emissions by providing the tools, technologies, education, information, and motivation needed to help all types of Americans change their energy consumption patterns and behaviors. Importantly, however, Americans are more likely to be successful in achieving these savings and in achieving them sooner if they are empowered by effective programs and policies that can help them to:

1. see more clearly the size of our current energy service demands, how those demands are currently met, and the implications for ourselves, our neighbors, and our children,
2. understand the range of energy options and choices from household to nation state,
3. imagine what a different energy future might look like,
4. prioritize social and governmental goals based on a long-term energy vision, and
5. make smart energy choices for their own household, business, or industry.

Currently scholars throughout the scientific community acknowledge that our nation's ability to achieve energy security and reduce our impact on the global climate will require that we tap into *multiple* sources of potential energy savings. Moreover, inefficient patterns of human behavior represent a large, untapped reserve that could (according to several estimates) potentially reduce current levels of energy consumption by 20-25%, and do so in ways that save money (Gardner and Stern 2008, Laitner et al. 2009). And the time is right for mobilizing the behavioral resource: energy use is at an all time high and energy service demands are even higher; people are increasingly concerned about climate change and high energy prices; new information and communications technologies are available for providing individuals, households, and businesses with a wide variety of previously unavailable information and feedback about their energy use patterns (and those of others); and the nation has experienced a notable shift in worldviews with an unprecedented proportion recognizing the need to moderate the human impact on the environment. In short, there is a real need to change our current patterns of energy use, and the vast majority of people agree that it is the right thing to do.[1]

Given this unique backdrop, we are faced with two important questions: (1) why aren't people currently acting on their beliefs and actively changing their energy consumption behaviors, and (2) what can be done to help them achieve these goals and accelerate our nation's transition to a low-carbon society?

The Behavior, Energy and Climate Change (BECC) Conference, held in November 2007, was a first attempt to address these concerns systematically in a conference setting. The BECC Conference, co-convened by the California Institute for Energy and Environment (CIEE), the American Council for an Energy-Efficient Economy (ACEEE), and the Precourt Institute for Energy Efficiency (PIEE) brought together more than 500 people to explore the topic, share their research, and consider potential program and policy options. This report seeks to build on that highly successful event by accomplishing two specific tasks: to provide a thoughtful framework for moving beyond the typical "rational economic actor" model as a means of understanding human behavior; and to explore some of the more prominent policy, program, and research topics that emerged from the BECC Conference.

[1] See the 2007 Gallup Poll that reports that nearly 4 out of 5 Americans believe that they should ride mass transit whenever possible and spend several thousand dollars to make their homes more energy efficient. The same poll indicates that approximately 70% of Americans believe that they should install a solar panel to produce energy for their home and use only fluorescent light bulbs. And a majority of Americans report that they should buy a hybrid car (62%) and unplug electronic equipment when not using it (57%) (Carroll 2007).

Frameworks and Core Theories

Efforts to understand human behavior must start with the recognition that people are motivated to action as a result of both economic and non-economic factors. As such, efforts that seek to maximize energy efficiency and conservation could substantially increase their effectiveness by integrating a broader set of social, cultural, political, and ethical factors that shape individual, household, commercial, and industrial energy service demands. This is not to say that energy prices, income, and other economic measures aren't important for understanding decision-making and behavior, but that a broader and more integrated approach is likely to provide a more accurate assessment of potential cost-effective energy savings as well as increase the effectiveness of programs and policies aimed at reducing energy consumption (Wilson and Dowlatabi 2007, Lutzenhiser 1993, Stern and Aronson 1984).

Economic and Non-Economic Factors

Currently, the predominant view of energy consumption and energy efficiency explains the problem as a function of consumer choices, technology adoption, and economic rationality. This framework identifies the individual in terms of his/her role as a rational economic actor making rational choices regarding the adoption of more or less efficient technologies and behaviors. A second approach constructs the problem by recognizing the broader social and cultural context in which decisions are made and behaviors are defined. This social/cultural framework situates the individual within the larger context, seeking to identify the ways in which social and cultural variables determine, and are determined by, energy-use behaviors. Of particular importance, this approach recognizes the significant influence of non-economic factors and the ways in which they shape and constrain individual behavior. Among the non-economic factors of interest are measures of social status, social norms, social institutions, and social movements.

A third approach constructs the problem primarily in political terms. Here the focus is on formal and informal political processes. Individual behavior is most effective via its ability to generate widespread change through the expression of political opinions and via the legislative process including the development and support of new laws, policies, and standards. From this vantage point, the media also plays a critical role in influencing public opinion, awareness, and concern regarding energy and climate issues. Finally, a fourth approach constructs the problem as a moral issue. The moral framework identifies the individual in terms of his/her philosophies, beliefs, and worldviews and seeks to understand how personal values shape behavior and energy consumption.

When combined with an assessment of structural and institutional barriers, the more complex representation of the multiple dimensions of human behavior can help ensure the development of more effective policy models, energy programs, and climate change policy. The remainder of this section summarizes important insights from selected policies, programs, and research as presented during the Behavior, Energy and Climate Change Conference. Various combinations of the frameworks discussed in Section IV provide the basis for many of these approaches.

Effective Policies

Far-reaching policies are essential for ensuring the effectiveness of efforts to change individual, household, and organizational behavior. Policies can make inconvenient behaviors convenient, they can make expensive behaviors less expensive, and they can remove structural, institutional, and legal barriers to behavioral change. Not surprisingly then, the effectiveness of behavioral interventions has been found to increase when combined with various policy instruments. Interestingly, however, policy models often fail to adequately integrate the social and behavioral determinants of energy

consumption and energy efficiency. The results are problematic for several reasons. Primary among these is the fact that potential, behavior-based energy savings are generally underestimated or assumed to be zero, while the behavioral opportunities often go unrecognized. Of course, unrecognized opportunities remain invisible to potential funders and unfunded programs have little impact on patterns of energy consumption.

Importantly then, until existing policies adequately recognize and pursue potential behavior-based energy resources, these important resources will continue to be underestimated and much of the potential savings will be left unrealized. As such, more research is needed to better document the size and scale of existing behavioral resources, measure their persistence over time, reduce the technology biases that are built into existing measurement and evaluation methodologies, and incorporate potential behavior-based energy savings into leading policy models. Also of utmost importance is the need for policies to recognize and accommodate the diversity that exists across the population in terms of energy use, social and cultural constraints and resources, and values, norms, and ideals. Although the "one size fits all" policies that are commonly used today may be cheaper, they also tend to be much less effective than those that seek to identify and address existing patterns of energy use and efficiency constraints. As such, cheaper approaches may also be less effective and less cost-effective. Moreover, in order to maximize the potential energy savings that we can achieve, we must also actively and systematically apply current social and psychological insights in ways that improve the likelihood that people will be successful in making smart energy choices. Too much information can be just as disabling as a lack of information, but the conscious structuring of choice architecture can go a long way toward helping individuals successfully navigate the many options that they face. Finally, we must also recognize that individuals do not make choices in a social vacuum. Insights from the study of organizational behavior and the experiences of trade allies are likely to be particularly valuable for expanding our current understanding of existing energy use patterns. Ultimately, we must strive to enable and facilitate smart energy choices and behaviors in a way that recognizes the diverse human and social circumstances in which those choices are made.

Behavior-Oriented Programs

Interest in behavior-oriented programs has resurged in recent years, but the programs that are evolving differ from prior attempts to change patterns of energy consumption in important ways. Of particular note, recent efforts are more innovative, more sophisticated, and more likely to effectively address the non-economic drivers of human behavior. These new programs borrow theories, ideas, and approaches from a variety of disciplines including public health, communications, sociology, anthropology, psychology, human ecology, public policy, business, and marketing, among others.

Among the methods used in the field of public health are entertainment-based approaches that allow people to learn new behaviors by vicariously experiencing the actions of other people through a process known as social learning. Many of these applications also employ sophisticated methodologies that require knowledge of the audience, the media, and the local resources. Similarly, efforts that use a social marketing approach often use competitions, social pressure, and social norms to favorably shape the behaviors of individuals and organizations, while other approaches study heuristic devices, persuasion mechanisms, and new high-tech modes of networking as well as their potential impact on energy consumption. Finally carbon labels and feedback devices are among the new tools being employed in some of the new, behavior-based energy programs.

Future program efforts should continue to innovate and experiment by drawing on lessons learned from other disciplines. In order to do so, programs need to be less risk adverse and more willing to "think outside the box." Some specific suggestions include the use of innovation inducement prizes, new branding and rating systems, community-wide programs, shareholder incentives, and home

energy rating systems. Programs should also emphasize the need for human-centered design and innovation that recognizes the complexities of human life and human decision-making, and produce technologies that meet both the explicit and latent needs of the individuals using them.

Behavioral Research

While there has been a notable re-emergence of interest in and work on behavior and energy issues, the lack of research since the mid-1980s has resulted in significant gaps in our knowledge regarding effective behavioral approaches. As such, there is no doubt that behavior-based efforts aimed at expediting our nation's transition to an energy-efficient, low-carbon economy will require a concerted and coordinated research effort. The good news is that a behavioral approach can provide a readily available and largely untapped source of significant energy savings. However, the danger lies in the potential for faulty assumptions and beliefs that understanding human behavior is simply an exercise in understanding the obvious. Instead, the timely development of useful knowledge will require the creation of a new research mechanism that (1) allows for the speedy accumulation of knowledge, (2) minimizes the duplication of effort, (3) maximizes the use of financial and human resources, and (4) provides a means of facilitating broad access to research findings.

Unfortunately, most current data collection efforts are disjointed and data are disbursed across a wide range of utilities, nonprofit organizations, government-run labs, and other organizations. Moreover, much of the data that has been collected is limited in scope and often out-of-date. Currently, a large portion of the data that are available has been collected at the program level and offer little insight into consumer and producer motivations and behaviors. Instead, research in this area would benefit greatly from studies focused on investigating how and why people adopt particular energy consumption and/or efficiency behaviors as well as studies that explain both the trends and the variation that exists among individuals and groups. A national energy efficiency data center could accomplish all of these objectives.

In terms of behavioral research topics, a number of areas deserve prompt attention. Of particular note is the need to reveal the important patterns and trends in energy consumption and energy conservation as they exist across specific segments of the population. Past efforts have focused on understanding "the average consumer" and are particularly problematic because they mask the dramatic levels of variation that exist among groups and/or segments of the population (see Lutzenhiser and Bender 2008). As a result, programs that target the average consumer will consistently miss their mark and be ineffective at reducing energy consumption. By studying the variation in patterns, programs will be more effective and efficient in their strategies.

New research efforts should also explore the importance of social context and social motivations and their impact on individual and organizational behavior. Contrary to prior beliefs, growing evidence suggests that people frequently fail to act in accordance with economic self-interests alone. In fact, people often find it difficult to do so. As such, it is important that new research adopts alternative models of human behavior and explores the ways in which social rules, resources, and contexts influence attitudes, preferences, and ultimately behaviors.

Finally, a concerted research effort is needed to explore a range of other important research topics including:

1. the impact of consumption choices and the energy embodied in the products that we consume,
2. the importance of symbolism, identity, and rebound in shaping energy consumption patterns and the persistence of savings,

3. the ways in which the variation in the visibility of energy and modern, urban lifestyles can shape energy consumption patterns,
4. the importance of choice points and the impact of choice architecture and trade allies on energy consumption,
5. the impact of behavior and social structure on patterns of energy consumption in businesses and industry, and
6. the best means of accelerating innovative behavior and the effectiveness of new technologies in reducing energy consumption.

These findings suggest that behavior-based programs and policies can dramatically reduce energy consumption whether in households, industries, commercial buildings, or cars. However, achieving these savings will require specialized knowledge, research funding and coordination, experimentation, innovation, and imagination. Given the challenges of climate change and dwindling energy resources, now is the time to tap into the existing reserve of behavior-based energy savings.

ABOUT ACEEE

The American Council for an Energy-Efficient Economy (ACEEE) is a nonprofit research organization dedicated to advancing energy efficiency as a means of promoting economic prosperity, energy security, and environmental protection. For more information, see http://www.aceee.org. ACEEE fulfills its mission by:

- Conducting in-depth technical and policy assessments
- Advising businesses, policymakers, and program managers
- Working collaboratively with businesses, public interest groups, and other organizations
- Organizing technical conferences and workshops
- Publishing books, conference proceedings, and reports
- Educating consumers and businesses

Projects are carried out by staff and selected energy efficiency experts from universities, national laboratories, and the private sector. Collaboration is the key to ACEEE's on-going success. We collaborate on projects and initiatives with dozens of organizations including international, federal, and state agencies as well as businesses, utilities, research institutions, and public interest groups.

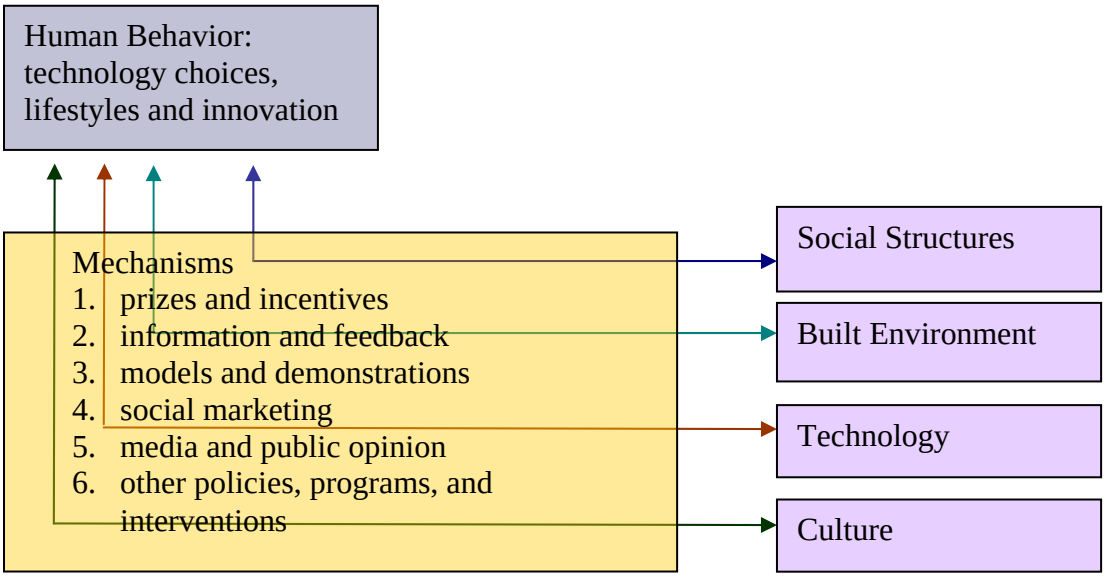
Support for our work comes from a broad range of foundations, governmental organizations, research institutes, utilities, and corporations.

I. INTRODUCTION

According to a recent Gallup poll, 77% of Americans report that they personally worry (either a fair amount or a great deal) about the availability and affordability of energy. In addition, 64% of Americans say conservation is the better approach to solving the nation's energy problems as compared to placing a greater emphasis on energy production (Jones 2007). Moreover, nearly two-thirds of Americans (61%) believe that the effects of global warming have already begun to happen (Dunlap 2008). Despite this large and growing concern for energy and the environment, an international study comparing the environmental sustainability of consumption practices in 14 different countries indicates that Americans are among the *least* green (Targeted News Service 2008). With regard to the environment and climate change, American behaviors clearly don't reflect our attitudes.

Why does this matter? According to a recent study by the American Council for an Energy-Efficient Economy, the accelerated adoption and improved use of cost-effective, readily-available energy-efficient technologies could reduce future levels of energy consumption by as much as 25 to 30% while also generating positive returns for consumers (Laitner 2008). And new innovations and inventions are likely to expand those savings opportunities. But shifts in technological regimes don't happen automatically. The mere development of new technologies doesn't imply that they will be adopted and/or optimally employed. Instead, potential technology-based savings must be *enabled* through human behavior. And shifts in lifestyles, habits, and innovation could further accelerate energy savings. In other words, although people are already concerned about energy, the environment, and climate change, the real challenge lies in translating those concerns into more energy-efficient actions and behaviors.

As such, both the causes of, and solutions to, climate change and energy demand are inextricably rooted in human behavior, social structures, and the built environment that are in turn the product of earlier choices, decisions, and habits and the social contexts that shaped them.



The key to changing existing energy systems is to empower people to establish new paths of energy use. As illustrated in Figure 1, a variety of mechanisms can be used to facilitate this change, including new policies, programs, and other interventions aimed at changing technology choices, lifestyles, and innovative behaviors as well as the social structures, built environment, technology

regimes, and cultural elements that shape choices, decisions, and lifestyles. The development of these mechanisms will require an improved understanding of current energy use behaviors and the forces that shape them. Such an effort should begin with a thorough mapping of both the homogeneity and heterogeneity in existing energy use patterns. Once the descriptive picture has been mapped, the effort should also identify the causal factors that shape individual and organizational energy use patterns. A comprehensive mapping will require an interdisciplinary effort that addresses both economic and non-economic drivers, both quantitative and qualitative influences, and both productive and consumptive energy end-uses.

This report seeks to lay the groundwork for a more comprehensive understanding of behavior, energy, and climate change in two ways: (1) by providing an initial discussion of some of the more important analytical frameworks and core theories, and (2) by identifying some of the most prominent topics and themes that emerged during the first Behavior, Energy and Climate Change Conference. Of particular importance in both of these efforts is the ability to move beyond simple economic models of human behavior to develop a more complete understanding of behavior that recognizes the social, cultural, political, and moral dimensions of human actions.

Following this introduction, Section II provides a brief overview of the Behavior, Energy and Climate Change Conference while Section III highlights four critical dimensions for understanding behavior-based efforts to reduce energy consumption and greenhouse gas emissions. Sections IV through VIII represent the core of the report, including a presentation of the analytical frameworks and theories (Section IV), as well as a discussion of policy directions (Section V), program innovations (Section VI), research paths (Section VII), and emerging research interests (Section VIII).

Of particular importance for understanding the cause-effect relationships that result in reduced levels of energy consumption, Section IV provides an overview of some of the more important analytical frameworks and core theories that seek to explain the non-economic aspects of human behavior. These frameworks provide a jumping off point in efforts to address a variety of questions surrounding the social, cultural, and psychological dimensions of energy consumption. For example, they provide a basis for exploring the ways in which social status, symbols, and consumer culture shape energy consumption as well as discuss the role of social norms, networks, and social movements in determining the direction of changing energy use patterns. In the political spectrum, the report discusses the degree to which political opinions, voting behavior, and political activism help shape policy and behavior. Finally, the last discussion in this section is concerned with the role of beliefs, values, religion, and worldviews in shaping human behavior and determining energy use patterns. Rather than providing a comprehensive discussion of relevant theories, Section IV is geared toward providing a more general overview for energy practitioners and others who are unfamiliar with the literature on the human dimensions of energy and climate change.

Sections V through VIII highlight the more prominent topics and themes that emerged from the conference as well as their implications for policy, programs, and future research. The report concludes by providing a set of specific policy, program, and research recommendations geared toward maximizing behavior-based energy savings and accelerating our transition to a low-carbon economy.

II. THE BEHAVIOR, ENERGY AND CLIMATE CHANGE CONFERENCE

The Behavior, Energy and Climate Change (BECC) Conference was held in November 2007 in Sacramento, California and was convened by the California Institute for Energy and Environment (CIEE), the American Council for an Energy-Efficient Economy (ACEEE), and the Precourt Institute for Energy Efficiency (PIEE). The conference sought to bring together researchers, policymakers,

program managers, and others to share insights; develop networks; and encourage research, collaboration, policies, and programs concerning behavior, energy and climate change. More specifically, the conference focused on developing an improved understanding of the energy-related behavior and decision-making of individuals and organizations. The ultimate goal of the conference conveners and organizers was to accelerate our transition to an energy-efficient and low-carbon economy through a better understanding and application of social and behavioral mechanisms of change.

With more than 500 participants from across the nation and numerous international participants, registration for the BECC Conference was more than three times initial expectations. Participants included a diverse group of academic and nonacademic researchers, advocacy groups, energy practitioners, government program staff, utility and business representatives, and legislators. Among the academic disciplines represented at the conference were sociologists, anthropologists, psychologists, and economists. More than 50 presenters shared their knowledge, research results, and insights on a broad range of session topics including (but not limited to):

- Influencing climate-related behavior through political action and social movements
- Understanding the importance of social norms and networks
- Improving assumptions, theories, and models
- Using behavior research as a resource for energy efficiency initiatives
- Learning from past energy efficiency programs
- Understanding opinions, attitudes, and segments within the population
- Building on the experience of public health initiatives
- Using information, education, and voluntary action mechanisms
- Improving policy design and political leadership
- Motivating individuals through social marketing and public programs
- Accelerating technology solutions
- Catalyzing change within the business community
- Working with community-based organizations

A large and growing number of people are interested in learning more about how policymakers and others can help accelerate our transition to an energy-efficient and low-carbon economy. Therefore, the three convening organizations (ACEEE, CIEE, and PIEE) will organize subsequent conferences on this topic. The next Behavior, Energy and Climate Change Conference will be held in November 2008 in Sacramento, California.

More information about future workshops and conferences can be found on the BECC Web site at www.BECCconference.org and on the ACEEE Web site at www.aceee.org/pubsmeetings/index.htm. Select conference materials (including some PowerPoint presentations) can also be found on the conference Web site.

This report is available electronically and can be downloaded as a PDF at www.aceee.org/pubs/E087.htm.

III. Behavior, Energy, and Climate: The Scope of Interest

Interest in behavior-based energy programs and climate policies can potentially cover a very broad range of topic areas from innovation and technology adoption to habits, lifestyles, and consumption patterns; from conscious efforts to reduce energy consumption to behaviors motivated by other concerns; from efforts aimed at changing consumer product choices to training programs for trade allies; and from efforts to reveal the patterns and trends in individual, household, and organizational

energy end-use (in the residential, commercial, and industrial sectors) to efforts to understand which of these areas of energy demand might be the most malleable.

Although many energy practitioners typically think about behavior-oriented programs and policies as limited to information campaigns, education initiatives, or incentive programs, this section briefly explores some of the broader thinking with regard to the behavioral landscape. As such, it includes a brief discussion of the division between behavior and technology, the importance of non-economic motivations and organizational behavior, the need to recognize the direct versus indirect energy implications of behavior, and the importance of social context in shaping individual behaviors and choices.

A. Behavior versus Technology

The adoption, use, and innovation of technology are firmly rooted in human behavior. Therefore, it is difficult to fully distinguish where behavior ends and technology begins or to determine how best to attribute energy savings—whether as a function of technology or behavior. In fact, most energy savings that are achieved through the application of new technologies also rely, to varying degrees, on changes in behavior.[2] Therefore, the types of behavior discussed in this report cover a wide range of energy-related behaviors including those associated with the adoption and use of new technologies as well as energy conservation behaviors associated with changes in habits, lifestyles, and consumption patterns.

B. Non-Economic Motivations and Organizational Behavior

Policymakers and program administrators are increasingly interested in finding effective ways to reduce energy consumption, increase energy efficiency, and reduce carbon emissions. And one of the primary benefits of the renewed efforts to study behavior, energy, and climate change is the promise of revealing the means to unlock a largely untapped reserve of energy savings. However, in order to be effective, these studies must also identify and explore the many motivating forces that underlie and drive common patterns of energy use whether they are economic, social, political, or moral in nature. In other words, among the topics to be studied are the political, social, economic, and moral pressures that must be brought to bear in order to maximize behavior-based energy savings. In order to accomplish this formidable goal, policies and programs must break free of the commonly held assumption that people are rational economic actors. Instead, successful efforts must recognize and further explore the reality that individuals don't always act in economically rational ways. Instead, people often make decisions and choices as social actors, political actors, and moral actors.

Of equal importance is the need to extend our thinking about behavior to encompass more aggregate-level actors: households, businesses, industry, government, educational institutions, religious organizations, or any other form of social group, sector, or institution. In other words, our understanding of energy consumption and energy conservation could benefit greatly from an expanded understanding of behavior that is broader than the traditional focus on individual-level behaviors, including those that typically correlated behavior with consumer choice.

[2] In fact, some researchers such as Laitner (2008) specifically characterize technology so as to recognize its human dimensions. Laitner's definition of technology is intentionally broad and includes "the cumulative knowledge embodied in our artifacts, equipment, and structures—all with an effort or desire to achieve a given social objective; and the norms and rules by which we choose to deploy that knowledge."

C. Direct versus Indirect Energy Consumption: Efficiency, Conservation, and Consumption

Everything we do and/or consume has energy implications. Our choices, whether conscious or not, determine the size of our energy (and carbon) footprint. Our choices may have both direct and indirect energy implications. *Direct* energy implication result from our decisions to turn up the heat in our homes, drive to work, or leave the computer turned on. Each of these choices has a direct impact on the demand for electricity, gasoline, or some other fuel source. But we also create patterns of energy consumption indirectly. *Indirect* energy implications result from our decisions to recycle, change our diets, or live close to work. These decisions determine the amount of energy required to make new products, meet our caloric needs, and be gainfully employed. Whether or not the products we buy and use consume energy to operate, their production and distribution inevitably require some measurable level of energy consumption. Importantly the indirect effects of our decisions are often much larger than people commonly imagine. Notably, therefore, we need to recognize both the direct and indirect implications of behavior for energy consumption and energy savings whether they result from programs or policies concerned with energy efficiency, energy conservation, new consumption patterns, or other means of changing overall levels of energy demand.

D. Social Context: Agents, Drivers, and Barriers to Change

Finally, the focus on behavior needs to recognize the importance of social context in shaping and constraining choices, decisions, and actions. In other words, while it is important to recognize that individual volition and actions are capable of creating society-wide patterns of change, historical events, contextual variables, and social dynamics also induce change. As such, we need to improve our understanding of the broader causes or forces that determine energy consumption and energy conservation. Such an understanding requires an exploration not only of individual decision-making and the ways in which individuals shape the social and physical worlds in which they operate but also of the ways in which social, physical, and historic contexts and dynamics shape individual behavior.

Accordingly, individuals must be recognized as potential agents of change but also as agents who operate within larger social, economic, and political contexts that facilitate certain behaviors and discourage others. This broader understanding of individual agency recognizes the importance of a wide variety of social and psychological variables that serve to shape energy use patterns. Contextual factors include public opinion, customs, social values, social structures, social norms, political context, standards, laws and regulations, economic conditions, technology options, social organization, and institutional barriers, among other factors that shape, constrain, and determine individual behavior.

IV. Analytical Frameworks and Core Theories

Efforts to reduce energy consumption, whether through efficiency or conservation, often employ one or more analytical frameworks that seek to understand and explain energy consumption through well-defined models of individual behavior. Of the four most common frameworks, the predominant construct views the problem as a function of consumer choices, technology adoption and economic rationality. This framework identifies the individual in terms of his/her role as a rational economic actor making rational choices regarding the adoption of more or less efficient technologies and behaviors. A second approach constructs the problem by recognizing the broader social and cultural context in which decisions are made and behaviors are defined. This social/cultural framework situates the individual within the larger context, seeking to identify the ways in which social and cultural variables determine, and are determined by, energy-use behaviors. Of particular importance, this approach recognizes the significant influence of non-economic factors and the ways in which they shape and constrain individual behavior. Among the non-economic factors of interest are

measures of social status, social norms, social institutions and social movements. A third approach constructs the problem primarily in political terms. Here the focus is on formal and informal political processes. Individual behavior is most effective via its ability to generate wide-spread change through the expression of political opinions and via the legislative process including the development and support of new laws, policies and standards. From this vantage point, the media also play a critical role in influencing public opinion, awareness, and concern regarding energy and climate issues. Finally, a fourth approach constructs the problem as a moral issue. The moral framework identifies the individual in terms of his/her philosophies, beliefs and worldviews and seeks to understand how personal values shape behavior and energy consumption. Each one of these frameworks will be discussed more fully in the following pages with the goal of providing a basic topographic map of the energy intervention landscape onto which the concepts and ideas of the BECC Conference can be situated.

A. Individual as Economic Actor / Consumer / Technology Innovator & Adopter

As stated above, in the past, the predominant approach to understanding energy consumption has been a rational actor model in which individuals make rational choices regarding the adoption of new, more energy-efficient technologies for use in home, business or industry. Changes in energy efficiency are primarily a function of technological innovation and technological diffusion as determined by income, price, payback and profitability.

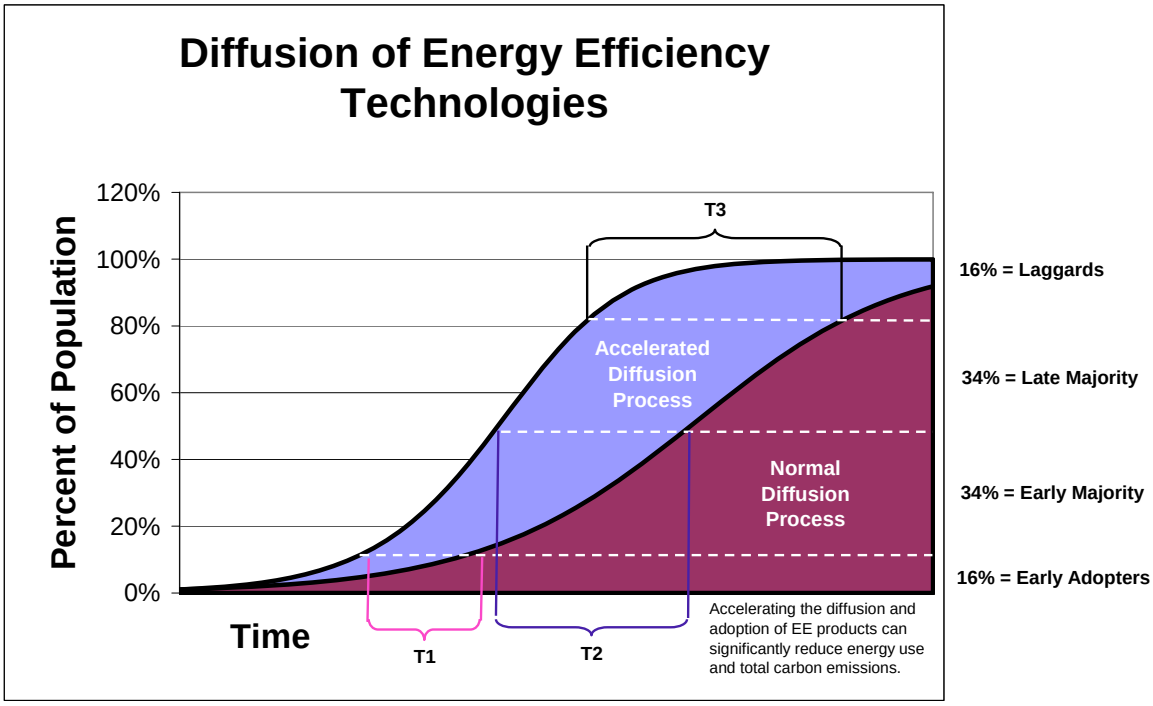
Whereas a strict engineering approach to energy efficiency may be able to provide information about the energy-savings and other potential benefits of specific technologies, it is less capable of explaining the variation in actual energy use and savings due to its inability to address the human dimensions associated with technology dissemination and adoption. By contrast, a techno-economic perspective adds to the explanatory capability of the framework by addressing the economic context in which given technologies are likely or unlikely to be adopted. The approach assumes that 1) individuals and firms will choose to perform energy-efficient behaviors and adopt more energy-efficient technologies if and when they are found to be economically advantageous, and 2) given adequate information, people will make rational economic decisions. As such, initiatives based on this approach tend to emphasize the need for economic incentives and disincentives as well as ensure that firms and consumers have access to reliable and easily accessible sources of information (Archer et al. 1987).

In general, the techno-economic perspective suggests a logical and linear framework of technological diffusion in which the technical expert defines a more efficient solution through a process of research and demonstration and the consumer adopts it and applies it when it is in his or her economic interest to do so (Parnell and Popovic Larsen 2005). As such, changes in energy consumption are seen as a function of economically rational decision makers confronted with changes in energy prices and technologies within a market setting.

Rational choice theory and diffusion of innovations theory are the formal theories that lie behind these models. Rational choice theory is a micro-economic theory that seeks to explain human behavior and social patterns as a function of individual choices. These choices are made with the goal of maximizing benefits and minimizing costs. According to the theory, individuals will choose the technology or behavior that provides the most benefits at the lowest cost. Thus when faced with the choice of which new refrigerator to buy, consumers will use information regarding the product, price, energy costs, interest rates and energy efficiency to assess which product will provide the desired level of services at the least cost.

Diffusion theory is concerned with how, why, and at what rate new technologies spread across a given society. This theory suggests that any given technology will progress through four stages of diffusion beginning with adoption by a limited number of "early adopters." Under the right set of circumstances, secondary and tertiary adoption groups will adopt the new technology in sequence followed by a final, fourth group of adopters. People seeking to accelerate the rate of adoption have focused their research on developing innovative marketing mechanisms and identifying network channels that could be use to facilitate and expedite the diffusion process.

Figure 1: Two Different S-Shaped Curves Illustrate the Diffusion Process



Demand-side management and market transformations programs represent efforts to apply a techno-economic approach to energy efficiency. Demand-side management (DSM) programs seek to influence the timing or quantity of energy consumption through the use of economic incentives and disincentives. More specifically, they work with residential, commercial and industrial energy users to reduce peak energy demand and increase energy efficiency through the use of energy price signals, product rebates, and other economic mechanisms. Incentives and disincentives are used both to change energy consumption behavior directly as well as to encourage the purchase and use of new, energy-efficient technologies.

Similarly, market transformation (MT) programs work with product manufacturers and retailers to encourage the broad diffusion of new, energy-efficient technologies by providing key market actors with information, incentives and disincentives (although not all within the realm of economics). Ultimately, the goal of MT programs is to encourage the production, availability, and distribution of efficient technologies to create permanent changes in economic markets so as to ensure continued efficiency gains even after the program has ended.

While some DSM and MT programs have also included elements from one or more of the other frameworks described below, the core approach is often rooted in a techno-economic framework. And despite the fact that these approaches have achieved some change, many people are skeptical about

the underlying assumptions, the mechanisms by which change has been achieved, and the likelihood of continued success. In particular, researchers and program implementers alike are often skeptical about the assumed economic rationality of program participants. In fact, evidence from several studies (Turrentine and Kurani 2007; Heffner et al. 2006, Kurani and Turrentine 2004, NRC 1984) indicates that the decision-making processes that are actually employed by individuals often differ dramatically from the assumed models of rationality. These studies raise numerous questions, for example: if participants aren't rationally assessing the costs and benefits of given technology choices, then what are the mechanisms by which change has been achieved, and how can we be sure of continued success?

Some studies have successfully documented that the actual decision-making processes of individuals are much less systematic and logical than portrayed by traditional models of human behavior (Ariely 2008; Brafman and Brafman 2008, Thaler and Sunstein 2008; and Turrentine and Kurani 2007). Instead, they show that decision-making processes are likely to include a variety of non-economic concerns (Cialdini 2005) and that decisions are often bounded by contextual factors resulting in outcomes that are less than optimal (NRC 1984).

The less-than-satisfying ability of these models to explain or predict energy consumption and technology adoption has resulted in the consideration of other frameworks for understanding behavior. Some of these alternative frameworks are discussed below.

B. Individual as Social and Cultural Actor

If we reflect on our own experiences, it becomes readily apparent that individual behavior and organizational decision making are not simply a function of weighing economic costs and benefits. Instead, individuals and organizations are also influenced in a variety of important ways by the social and cultural environments in which they live their everyday lives. Our purchasing decisions, consumption patterns, and lifestyles are not only determined by our income and our expenses but they are also a means of expressing our identity to others, conveying our prestige, competence and success, and of "fitting in" with others like us. Two of the biggest purchasing decisions that we make — a home and a car — come with significant energy implications. However, neither decision is likely to be made on the basis of energy efficiency or fuel economy alone. In fact, until recently — despite rising fuel prices — these considerations often had no bearing whatsoever on our purchasing decisions. Instead, purchasing decisions, and even habitual behaviors, are heavily influenced by social norms, social networks and social institutions that shape and constrain our individual preferences and behaviors. This realization has lead to a somewhat broader understanding of energy use and energy conservation behavior. Some of these ideas are explored briefly below.

Culture, identity, and symbolic value. Consumer goods are purchased not only for their utilitarian value but also for what they say about us as individuals. In the latter sense, goods carry symbolic values that are used to communicate information about who we are, or who we aspire to be, to the rest of society. The most obvious way in which consumption holds symbolic value is in expressing social class or social status. As such, certain products signify wealth such that "goods serve as proof of social status." According to Veblen's concept of conspicuous consumption (1899) many people buy things for the sole purpose of demonstrating their affluence, status and self-worth. Cars are among the products that people perceive as status products (Waldrop 1989). "In our own culture, the enormous symbolic significance of vehicles is so obvious that it is too easily taken for granted (Csikszentmihalyi and Rochberg-Halton 1981)." Similarly, the size of our house and where we vacation also say much about our social status. Interestingly, however, social status isn't the only type of message sent via our consumption patterns. More recent studies indicate that we also use goods to communicate other aspects of our identities.

For example, a recent study by Heffner et al. (2006) that focused specifically on the symbolic meaning of automobiles assessed how individuals use the meaning in their automobiles to form and maintain other aspects of their self-identities. According to the study, modern culture has increasingly required that each individual actively define and construct his/her identity. Consumer products, including the cars that we choose to drive, help us to achieve these ends. "For some individuals, pickup trucks make them members of red-state nobility, minivans identify them as loving parents, and HEVs show that they are ethical people" (Heffner 2006: 32). As such, automobiles provide both function (use value) and meaning (symbolic value). Despite the fact that a simple analysis of use value alone cannot provide a full understanding of consumer benefits and consumer preferences, many assessments of consumer demand continue to rely on this limited approach. According to Heffner et al. (2006):

> *Focus on use value is also evident in the recent assessment of consumer demand for new types of vehicles. For example, some authors question the value proposition of HEVs, pointing out that consumers may wait years to recover the initial expense of their hybrid, and many will never be fully "paid back" by the new technology at all (Bedard 2004, Isidore 2004, Edmunds 2005). This analysis ignores the fact that HEVs deliver substantial meaning to their owners, and symbolic meaning generates value for consumers just as use value does. Symbols matter in vehicle purchases, and whether new automotive technologies such as hybrid-electric and fuel-cell vehicles are accepted in the marketplace depends partly on the symbolic value they deliver to buyers.* p. 32

These studies suggest that a more comprehensive understanding of consumption preferences might facilitate the development of more effective programs and policies geared toward reducing energy consumption and carbon dioxide emissions. We need to improve our understanding of consumer choices and consumption patterns, the role of consumer marketing in shaping these choices, and the means by which to make energy efficiency and energy conservation more attractive to a broader segment of the population.

Social norms. In addition to establishing identity through symbolic meaning, it is also important to recognize that purchasing decisions and energy-related behaviors are also shaped by existing social norms. Social norms can be thought of as informal social controls that shape individual behavior or as agreed-upon-standards of behavior to which we seek to conform in order to be accepted by other people like ourselves. As individuals, we seek to behave in accordance with social norms not only because our friends, neighbors, and colleagues expect us to act according to certain standards but also because straying from established norms can place our self-respect at risk. With regard to energy use, people use both descriptive norms (information about what most people do) and injunctive norms (information about what most people believe is right to do) to determine their own personal course of action.

Two examples highlight this point. First, in a recent study of hotel guest behaviors, Cialdini (2005) sought to increase the number of guests that were willing to reuse their towels instead of having them laundered on a daily basis. The study left cards in each hotel room asking guests to reuse their towels and noted that the majority of people staying in the hotel had, at some point in their stay, reused their towels. By emphasizing the behavior as normative, Cialdini was able to lift reuse rates from 35% to 58%, saving both water and energy

In another study, Schultz and his colleagues (2007) used a social norms approach to help homeowners to conserve energy. The study involved delivering notices to household doorsteps, telling

homeowners how their energy consumption compared to the neighborhood average. Homeowners who were consuming more electricity than their neighbors reduced their consumption.

Importantly, numerous studies have found that people tend to "decide" on an "appropriate" course of action based on what other similar people do and what other people believe is the right thing to do. In other words, people glean information from their own observations and interactions with others as well as from the media and other sources of information as to how other people like them act in similar situations. People then use this information to discern a "socially rational" course of action (Ehrhardt-Martinez 2008). These insights challenge the standard model in which behavioral change tends to be framed exclusively as a matter of individual preferences and predominantly in terms of rational *economic* actors. By using a social model, it becomes clear that product price, disposable income, and payback period are not the sole drivers of consumer preferences and behavioral decisions.

Social networks. In today's society, with the advent of the Internet and many other new sources of information, most people are faced with an overabundance of information. For those interested in efficiency and conservation, the challenge is no longer to find relevant information but to determine which sources are valid and reliable. In this context people often turn to people that they know and trust — people in their own social network. These networks are composed of the relationship structures that we share with other people whether they are family members, friends, colleagues, members of a club or organization, or some other person with whom we interact on a regular basis. However, in contrast to other types of social science assessments that assume that behavior is determined through socialization and social norms, a network approach focuses on the structure and composition of social ties and how they affect norms.

Research indicates that social networks shape individual and organizational behavior in numerous ways including the way that problems are solved, the way in which organizations are managed, and the degree to which individuals are successful in achieving their goals. Generally, people with larger networks are thought to possess more social capital or have more social resources at their disposal, although the types of relationships and individuals can also be used to assess social capital as well. Social networks can be diagramed to assess the number and characteristics of relationships between individuals. Individual actors within the network are represented by points, while the relationships among actors are represented by lines connecting some points to others within the diagram.

Some recent efforts to understand energy conservation behavior have focused on understanding the role of social networks in determining individual behavior. Of particular interest has been the current and potential role of new Internet technologies in establishing on-line networks of people with similar interests across vast geographical areas. For example, in their conference presentation Mankoff and Fussell describe a recently initiated research project in which they use online social networking sites to increase awareness of climate change issues, educate users about their contributions to climate change, encourage people to take action, and provide rewards based on the actions taken. See Mankoff and Fussell (2007) under BECC Conference Presentation References.

Social movements, mobilization, and grassroots change. In today's world of nearly seven billion people, we don't typically think of everyday individuals as capable of creating lasting social change. However, when people are motivated to come together to create a unified voice in favor of, or in opposition to, a particular practice, they are often able to gain more recognition than if they had acted alone. In the process, these movements are often successful in raising a broader level of awareness and participation of others. When they are effective, social movements can change individual behaviors by changing attitudes and opinions, by modeling desired behaviors, and by challenging existing social norms and laws.

Concerns over global climate change have sparked the development of a variety of efforts to mobilize the public both to create effective policies as well as to influence individual behaviors. Recently, groups such as Focus the Nation and the California Student Sustainability Coalition have effectively mobilized college students and young people around the national to protest and work with school administrators to create new energy policies on their school campuses and elsewhere. Similarly, a variety of religious groups including Interfaith Power and Light have also sought to mobilize their congregations to take steps to reduce their collective impact on the climate.

When social mobilization occurs through existing organizations, it can often de-stigmatize issues that would otherwise seem radical or foreign to the mainstream population, facilitating its diffusion more broadly. Social movements work through both new and established networks of people who actively seek to change individual behavior by challenging existing social norms and/or social structures. In its recent campaign to focus the national on the issues of global climate change, Focus the Nation mobilized nearly one million people at more than 1900 events. These events provided students and other citizens the means to learn more about the issues and also challenged participants to begin to take action. (More information is available at www.focusthenation.org.)

Energy infrastructure and social structures — barriers and mechanisms of change. Existing energy infrastructures and social structures can act as both barriers to and mechanisms for behavioral change. Of particular note with regard to existing energy infrastructures is the invisibility of energy. According to a publication by the National Research Council (NRC 1984), "the history of material progress over the last century has made energy sources less costly in real terms and has made energy flows invisible to energy users."

Since the turn of the 20th century, as a society we have dramatically shifted our fuel use patterns in terms of the type and quantity of fuel used. For example, in terms of home heating we have gone from chopping wood, to shoveling coal, to purchasing fuel oil, to the almost effortless use of natural gas and electric furnaces. In the process of this transition, our active involvement in the process of heating our homes and our visual appreciation of the volume of our fuel consumption have been diminished to the point that energy consumption has largely become invisible and the only remaining visible aspect of energy is the monthly bill (NRC 1984). At the same time, there has been tremendous growth in the energy services on which we rely, including air conditioning, heating, cooking, lighting, computing, television, and the whole assortment of new electronic gadgets available today. The resulting paradox is one in which energy is both more integral to our lives and our lifestyles, while it is less and less visible in our everyday lives.

The invisibility of energy has important implications for energy use and energy efficiency in that it makes it difficult for consumers to take effective action to reduce consumption. When consumers only source of information comes in the form of a monthly energy bill, it becomes difficult to evaluate the components of energy consumption and determine effective interventions. What is running up the electric bill? Is it the refrigerator, the hot water heater, or something else entirely? When it is impossible to identify the contributions of individual appliances, reducing energy consumption becomes increasingly complicated. Efforts to make energy visible are further complicated by seasonal variations and changes in power demand that make it difficult to evaluate the effectiveness of particular conservation efforts. Furthermore, while the specific design and construction features of buildings, cars, appliances, and industrial equipment can dramatically affect energy-efficiency, these characteristics and their energy implications are also often invisible to the consumer.

Recognition of the problems associated with energy's invisibility has sparked a variety of efforts to study the behavioral implications of providing feedback to energy consumers. For example, Winkler

and Winett (1982) reviewed 19 sets of data from experimental studies in which households were informed frequently (usually daily) about how much energy they were using. The feedback made energy more visible to participants who modified their habits and reduced their energy consumption by as much as 20%. The authors also found an interesting interaction between the effectiveness of the feedback and energy prices such that the feedback was found to be even more effective when energy prices were higher.

More recent research has explored the effectiveness of new, high-tech devices for providing feedback. A recent study by the U.S. Department of Energy explored the ways in which ICT and advanced metering technologies could reduce electricity demand. The advanced technologies allow consumers to trade flexibility in electricity demand for lower costs when there is a shortage–and it gives providers the demand information they need to determine the actual cost of generation, transmission and distribution in near-real time. The study found that participants reduced their energy consumption simply because their energy use was more visible and because they had greater control over their energy consumption decisions (Hammerstrom et al. 2007).

With regard to social structural barriers, researchers have identified at least three important impediments to behavioral change: principal agent barriers, shifting demographic structures, and barriers associated with production structures. In the first case, consumer choices are limited when intermediaries make choices for energy users such as when builders or landlords select appliances or choose heating and cooling equipment often without concern for the energy efficiency of said equipment since the intermediary is not required to pay for the subsequent energy use. Similarly, shifting demographic structures "affect both the patterns and the magnitude of energy use (NRC 1984)." For example, the number of people per household has shrunk from 3.14 in 1970 to just 2.56 in 2007. The diminishing size of American households means that even if the population remains constant in size, the number of residences must increase. During the same period, however, the U.S. population has grown by nearly 50 percent from 203 million to 302 million. The combination of factors has resulted in greater energy service demands. Similarly, the growth in dual-income families has also resulted in increased energy consumption in transportation and the use of labor-saving appliances such as dishwashers.

Social marketing — motivation and information sharing. Although born as a discipline in the 1970s, the contributions of social marketing programs have increased in more recent years. Social marketing is generally thought of as a means of planning and implementing programs to bring about social change using concepts and principles from commercial marketing. However, social marketing is also concerned with the various individuals and groups involved in the program, the organizational partnerships involved with developing and implementing the program, the policy environment in which the campaign is operating, and the limited financial resources that are available to fund the programs (Weinreich 2007). As such, social marketing is simultaneously concerned with the diffusion and adoption of ideas and technologies and the use of social and psychological mechanisms to facilitate that diffusion.

For instance, many social marketing programs attempt to create lasting behavioral change through the use of public and private commitments that have proven to be important mechanisms for internalizing behavioral motivations. Programs that rely on commitments are based on the minimal justification principle which "emphasizes the distinction between strong and weak external justifications for behavior." According to the principle, powerful external justifications result in short-lived behavioral changes, while moderate justifications are more likely to generate strong internal mechanisms of control and the perception among program participants that the motivation to conserve is internally motivated, resulting in longer-lived behavioral change.

Most programs that use a commitment approach define it in terms of an "individual's stated intention to engage in a particular action or fulfill a specific goal under conditions of minimal external pressure" (Katzev and Johnson 1987: 110). Participants may either be asked once to make a commitment (a single request procedure), or asked several times to make successively larger commitments. Two single request studies of residential energy consumption (Becker 1978 and Pallak et al. 1980) asked homeowners to make a commitment to curtail their energy consumption. Becker's study found that individuals who where asked to make a commitment to a goal of a 20% reduction (over a three-week period) were successful in reducing their consumption by 15% with the aid of regular feedback. Participants who committed to smaller goals of a 2% reduction did not achieve any reduction in energy use. The Pallak et al. study also looked at the effect of public versus private commitments on energy conservation. Not surprisingly, individuals who made public commitments used significantly less electricity and natural gas than both control subjects and those individuals that made private commitments.

Examples of social marketing campaigns that use commitments and other social and psychological approaches abound, however a comprehensive review of their impact on energy savings has yet to be researched and written. Nevertheless evidence from a Canadian program provides some insights as to the potential effectiveness of social marketing campaigns.

The Canadian program, called 20/20 The Way for Clean Air, was launched in 2002 and set out to improve air quality in the greater Toronto area and reduce energy consumption by 20% by 2020. The campaign is focusing on engaging "residents, both at the individual and collective level, in taking actions to reduce air pollution." A variety of measures are being used to not only provide information but to motivate action. As of 2004, this combined approach had achieved: a 19% reduction in household energy consumption, a 15% reduction in the vehicle kilometers traveled per household, and an average of 1.2 tonnes emissions reduction per household (Cullbridge Marketing and Communications 2007). Although the results for this program are based on the self-reported behavior of participants, they suggest that social marketing approaches that combine effective information dissemination techniques with other means of promoting behavioral change can be effective tools for achieving energy conservation and efficiency. Also see Hickox (2007) under BECC Conference Presentation References.

In general, perspectives that focus on the individual as a social actor recognize that while individuals are often perceived as being free agents,

- their motivations are not strictly economic in nature,
- their choices and actions are constrained and shaped by social forces and structures that often serve to maintain the status quo, and
- the barriers, resources, and opportunities that they face vary across different groups of individuals and segments of the population.

C. Individual as Political Actor

Prior to this point we have been concerned with individual behavior primarily in terms of the forces that determine why and when individuals adopt energy-efficient and energy-consuming technologies and/or participate in energy conservation behaviors. However, this section broadens our definition of individual behavior so as to consider the individual as a political actor and assess the ways in which individual opinions, voting behavior, and political activism can change the political landscape and accelerate our transition to an energy-efficient and low-carbon economy.

Public opinion. In democratic systems of government, policy decisions both shape and are shaped by public opinion. Similarly, *individual* attitudes and behaviors are also often shaped by the popularly held attitudes and opinions of other individuals, organizations, political actors and the media. To date, the most important approaches to the study of public opinion have been concerned with measuring the ways in which opinions vary across different segments of the population as well as how sets of ideas and opinions tend to cluster together and form the predominant public opinion on an issue. Work in this field is also often devoted to describing and analyzing the ways in which public opinion shapes public institutions, social norms, public policy, and personal beliefs as well as studying the role of communications media in shaping and disseminating the ideas on which opinions are based.

Interestingly, many studies have revealed that public opinion on energy consumption and production and ideas regarding climate change can shift significantly as a result of numerous factors including changing economic conditions, media coverage, policy proposals, and natural disasters. For example, recent increases in energy prices have resulted in greater public support for off shore drilling and the development of nuclear power (New York Times 2008), while the increasing severity of natural disasters such as hurricane Katrina have coincided with growing concerns about climate change (McKibben 2007). According to data collected by the Gallup Poll, in the past decade the proportion of Americans who believe that global warming will have a serious impact on them or their way of life during their lifetime has risen from 25% to 40% (Dunlap 2008).

Public opinion researchers have also studied the relationship between opinions about energy issues on the one hand and attitudes regarding climate change on the other. This area of research is concerned with the ways that energy prices and energy security might affect popular support for climate change legislation, policy priorities, or individual behavior directly. Finally, media attention can also shape public opinion and of particular interest are studies that investigate the specific types of media and methods of employment that have had the biggest impact on public opinion, public awareness, and behavioral change.

Voting behavior. Of particular interest to those involved in the political process is an understanding of the various factors that influence voting behavior. Voting behavior can have a direct effect on energy and climate change policies when citizens vote on a related referendum and an indirect effect when they vote for candidates who propose various energy and climate change policies. Most studies of voting behavior focus on the relationship between public opinion and voting behavior. However other studies of voting behavior cross multiple disciplines from psychology to sociology to political science and are based on a wide range of theoretical frameworks including theories of reasoned action, quality of information, agenda setting theory, public choice theory as well as others.

For example, the ***theory of reasoned action*** (Ajzen and Fishbein 1980; Ajzen 2002, 1991, 1988, 1987, 1985; Sheppard et al. 1988; Hale et al. 2003) argues that behavioral intentions (BI) are a function of both attitudes about the behavior (A) and subjective norms (SN) such that BI = A +SN. The underlying assumption is that people will carry out their intended behaviors in the absence of insurmountable barriers. However, the strength of behavioral intentions can vary according to 1) a person's attitudes or beliefs regarding the consequences of performing the behavior, and 2) his/her beliefs about how people s/he cares about will view the behavior in question. Later work also recognizes the importance of perceived behavioral control which can be easily added to the equation to account for the effect of people's perceptions regarding their ability to perform a given behavior. Generally, however, individuals with more favorable attitudes and subjective norms will have stronger behavioral intentions. Similarly, behavioral intentions are likely to be stronger among people with higher levels of perceived control.

Quality of information frameworks are concerned with how the quality of available information affects voting behavior and abstention from voting thereby affecting election results. For example, Ghirardato and Katz (2002) argue that citizens may choose not to vote if the policy positions of both candidates are ambiguous and a particular candidate appears more favorable under certain scenarios while the contending candidate appears more favorable under other scenarios. Similar issues are also discussed by a variety of other authors (including Merlo 2006, Lassen 2005, Parlfrey and Pool 1987, and Macaluso 1977) who explore the relationship between information, ideology and voting behavior.

Agenda setting theory is focused on how campaign news coverage and advertising can influence the importance of issues and national events in voters' calculations. According to this approach, candidates can choose from two campaign strategies: issue ownership or ride-the-wave strategies. Issue ownership strategies require that the candidate increase the salience of issues on which his/her party has demonstrated competencies. On the other hand, ride-the-wave strategies attempt to coordinate campaign targets with issues covered in the U.S. news. Research has found that issue ownership strategies are more effective strategy (Abbe et al. 2003). According to the research, voters are more likely to support candidates whom they see as being more competent on their issues. "When candidates campaign on issues traditionally associated with their party, they encourage voters to focus on these issues and to use them to cast their ballots." However, candidates must campaign on a "well-defined agenda" in order to ensure that party-owned issues have an impact on voter choices. Given the growing importance of global climate change, this perspective suggests that candidates need to make this issue a central part of their campaign agenda and then attempt to convince voters of their party's competence on this issue.

Finally, ***public choice theory*** uses several economic tools such as game theory, decision theory and utility maximization to study voting behavior and collective decision making. One of the predominant assumptions underlying public choice theory is that people's actions and behaviors are rooted in rational self interest. In other words, whether people are acting as voters, bureaucrats, politicians or lobbyists, their primary motivation is a concern for themselves as opposed to a concern for others or the public good.

Interestingly, however, this theory also argues that because voters tend to act in their own self interest, they often don't vote. Low rates of voter participation are attributed to the accurate assessment on the part of voters that their vote has virtually no chance of changing the outcome of an election. Even when voters do vote, they are often largely uninformed because they fail to invest the time needed to be adequately familiar with the issues. Similarly, although our political system is rooted in the expectation that legislators will pursue the public interest, public choice theory posits that without the careful oversight of voters, legislators are given little motivation to prioritize the public good over their own welfare. Even though politicians might prefer to use public funds to the maximum benefit of the public, they are much more likely to benefit both financially and politically by acting in accordance to the interests of powerful interest groups. Among the solutions offered by public choice theory is the common recommendation to limit government action as much as possible to local forms of government and to allow for competition between service providers so as to ensure maximum efficiency of government entities.

Finally, free-ridership is another concern addressed through public choice theory. According to the theory, large interest groups often face significant difficulties mobilizing and maintaining the support of all the people who benefit from their efforts.

From a climate change perspective, public choice theory can improve our understanding of the relationship between the media, public opinion, support for climate change policy, political action, and voting behavior. Similarly, economic applications of public choice theory are able to employ

social choice modeling and game theories to help policymakers and others to anticipate voting behaviors and assess the political popularity and support for likely voting outcomes.

D. Individual as Decision-Maker and Moral Actor (Doing What's Right) — Beliefs, Ethics and Worldview

The final approach to understanding individual behavior and its effect on climate change and climate policy is one that is focused on the ethics, values, worldviews and systems of understanding practiced by individuals and the ways in which they shape individual behavior, social norms and social structures. This approach involves the disciplines of psychology, anthropology, ethics, religion and history (among others) and is suitably expressed in the following excerpt:

> *The environmental crisis is an outward manifestation of a crisis of mind and spirit. There could be no greater misconception of its meaning than to believe it is concerned only with endangered wildlife, human-made ugliness, and pollution. These are part of it but more importantly, the crisis is concerned with the kind of creatures that we are and what we must become in order to survive. (Lynton K. Cadwell, quoted by G.T. Miller, 2005:1)*

This observation is equally appropriate for concerns about climate change. For example, declining energy resources and concerns about global warming have been the topic of discussion for three decades or more. However, despite a vague sense of pessimism, as individuals we continue to live our daily lives without significant changes in our behavior. As appropriately noted by Du Nann Winter and Koger (2004: 2), "…we worry more than we act." This observation is supported by survey results that indicate that while 83% of U.S. citizens are concerned about the environment and believe that some action must be taken to address environmental problems, only 18% are actively participating in such efforts (Dunlap and Saad 2001). This gap highlights an important disconnect between attitudes and behaviors; between ethics and actions. How can we explain our failure to walk the talk? To take responsibility for our own actions? To change our personal contribution to climate change? While part of the discrepancy can be explained by the approaches discussed earlier, it is equally important to recognize, understand, and address the psychological and ethical roots of these problems that have emerged from particular patterns of thoughts, beliefs, values, and worldviews.

Social psychology, cognitive psychology, anthropology and ethics are among the disciplinary approaches that offer a wide variety of perspectives (too many to review in this document) for understanding the many ways in which our beliefs, values and worldviews develop, persist, and change and how that understanding might be applied in efforts to address energy and climate change issues. This discussion is meant to simply provide a brief introduction to psychological and ethics-based frameworks for understanding environmental problems and human behavior.

Beliefs, information, and understanding. Cognitive psychology is primarily concerned with understanding the ways in which inadequate or bad information, erroneous beliefs, and imperfect processing patterns can result in environmentally destructive behaviors. From this perspective, cognitive errors, resulting from the use of cognitive shortcuts, are often the impetus behind various types of environmental degradation. Unfortunately, these types of errors are relatively common and from an environmental perspective, they can wreck havoc. See, for example, Thaler and Sunstein 2008; Kahnemann et al. 2000; and Kahnemann et al. 1982.)

Nevertheless, people use cognitive shortcuts because they often provide us with faster and more efficient means of making decisions. Unfortunately they also often come with unforeseen environmental costs. Cognitive psychology seeks to reveal how and when these problems occur and

to resolve them by providing better and more complete information as well as better decision making tools, skills, and capabilities.

For example, Du Nann Winter and Koger (2004: 159-160) point out that as a species we are much more dependent on our visual senses than touch, taste, smell or hearing. This visual dependence causes us to largely disregard environmental problems that we cannot see — problems like global warming. "Because we cannot directly see chlorofluorocarbons (CFCs) or greenhouse gases, it is less likely that we will notice their significance, or keep their importance paramount in our thinking." Selective attention and sensory adaptation also influence our ability to process information. For example, in order to limit the amount of stimuli that we need to process, people unconsciously delegate their attention to those areas in which it is required. And we tend to tune out or ignore the rest. Of course, information that is tuned out doesn't get processed. If we don't notice it, we don't act on it. Similarly, our nervous system is also hardwired to pay attention to environmental stimuli when they are changing but to tune out stimuli that don't change. As a result, situational features that change too slowly or not at all fail to capture our attention as a result of sensory adaptation. Finally, research has shown that people tend to be more motivated by short-term, concentrated benefits than by long-term, diffused costs. This tendency, known as proximal cognition, has been shown to reduce investments in insulation upgrades and energy-efficient appliance purchases even though the investments would pay for themselves over the long run.

Heuristics and framing effects serve as additional constraints on information processing and can lead to poor decisions and behaviors when it comes to the environment. Heuristics represent quick short cuts to problem solving or "rules of thumb" that allow people to think quickly and efficiently. But they don't always result in good decisions. Finally, the way in which information is framed or presented can also have an important impact on decision making behavior. For example, in a study of behavior and the energy efficiency of water heaters, individuals were found to be "more likely to invest in a water heater wrap if it was presented a s away to avoid losing money rather than as a way to save it" (Yates 1982 as cited in Du Nann Winter and Koger (2004: 173)).

Ethics, values, and worldviews. Moral philosophy and ethics provide information about how beliefs, values, and worldviews provide each of us with frameworks for understanding the world around us as well as determining the "right" way to think and behave. In this sense, ethics, values and worldviews provide an important means of explaining the choices that people make as well as the ways in which they behave. This approach takes the perspective that getting people to act in more environmentally sustainable ways requires a shift in values and in their basic understanding of how the world works.

According to Du Nann Winter and Koger (2004: 65), "worldviews are a coherent picture of reality and one example of our attempt to figure out the world." The basic premise is that our ideas shape our values (White 1967). And that ideas and values work together to form our larger worldview. Religion has clearly played an important role in shaping modern worldviews as well as perspectives on the environment. However, there are also other systems of understanding that have played equally important roles. For example the value systems that lie at the heart of our economic and political systems also shape our perspectives on the environment. Capitalism, democracy, individualism, equality, modernization and technological progress are just a few examples of important systems of values that shape both our worldview and our environmental attitudes and behaviors.

Interestingly, research on this topic has revealed that specific environmental beliefs tend to clump together forming two different social paradigms and that people tend to fall in one camp or the other: either the dominant social paradigm of human exemptionalism or what Dunlap calls "the new ecological paradigm" (Dunlap et al. 2000). The dominant social paradigm reflects a belief in "abundance and progress, growth and prosperity. It is based on a faith in science and technology, and

a commitment to a laissez-faire economy. Finally, it advocates limited government planning and emphasizes private property rights" (Dunlap and Van Liere, 1978: 10). This paradigm represents the modern Western worldview that land should be used for economic gain and individual profit and that people have a right to develop land for their private well-being. People who share the dominant social paradigm tend to show less concern about a variety of environmental problems including population growth, pollution, environmental regulations, etc. On the other hand, the new ecological paradigm reflects higher levels of concern for the environment and support for pro-environmental policies. People who share this paradigm believe that current population levels are unsustainable, that we are on course for a major ecological catastrophe, and that the balance of nature is delicate and easily upset.

Importantly, however, while the link between values and attitudes is relatively clear cut, the link between values and behaviors is less so. In other words, pro-environmental values are much more highly correlated to pro-environmental attitudes than they are to pro-environmental behaviors. Similarly, it is also unclear whether or not changes in worldviews are likely to result in a shift in U.S. energy policy. Nevertheless, it is interesting to note that since 1976, there has been a dramatic increase in support for the new ecological paradigm in the U.S. And while it is unclear whether or not changing worldviews are likely to result in a shift in US global climate change policy, it is clear that should the federal government decide to tackle climate change there is a broad and growing base of support that policymakers can tap into.

V. POLICY DIRECTIONS

Energy-efficient behavior as a resource. Understanding human behavior and decision-making is critical to bringing about an effective response to climate change, but incorporating behavior change into energy-efficiency policy and programs presents a unique set of challenges. Some of the core questions that must be addressed include:

- Do we currently know enough about behavior to approach it as a reliable resource?
- How much savings can be generated through behavioral change?
- Can behavior change result in persistent savings?
- How do "behavioral" interventions such as social marketing (that rely on voluntary action) compare to traditional "technology" programs (that often involve subsidies)?
- How do concerns about global warming change this picture?

Supporters of behavior-based interventions and research often cite the limited success of past policy and program efforts as evidence of a need for a new approach. A particularly salient point of criticism focuses on the fact that past policy and program efforts have held a somewhat strict reliance on what has become known as the techno-economic model (see page 16 for a description). Such an approach tends to focus narrowly on the technological and economic dimensions of energy consumption and to exclude considerations of behavior from policy considerations and interventions. The techno-economic model is currently at the heart of energy and climate policy in the United States. Nevertheless, there has been a growing interest in capturing potential behavior-related energy savings. However, efforts to do so will require additional investments of time and resources to document the quantity of both past and potential behavior-related energy savings. In the short term, research funding is required to distill as much information as possible from the numerous, albeit fragmented, studies that exist on energy-efficiency behavior as well as those written on energy conservation behavior. This type of assessment would allow researchers, utilities and others to begin to form estimates of the size and durability of energy savings. In addition, more psychologists, sociologists and other social scientists should be hired to determine the direction of future research

efforts; to decide which questions need to be asked; and then to oversee the research required to answer them. Despite these research needs, a number of organizations including the California Public Utilities Commission (CPUC) have expressed interest in supporting efforts to capture energy-efficient behavior as a resource if research efforts are able to provide quantitative evidence that behavior-based interventions are effective ways of increasing the number of people, firms or households interested in adopting more efficient technologies and behaviors or of increasing the consistency and/or effectiveness of behavioral change. In fact, in an effort to better understand these potential opportunities, the CPUC recently commissioned eight research papers on behavior-related energy savings. (See Appendix E for a complete list of recently commissioned CPUC White Papers.)

Utilities also face a similar conundrum. For planning purposes, the electric utilities must be able to accurately predict future energy demand in order to ensure adequate supply. Although they may be interested in behavior as a resource, they are more concerned with the reliability and durability of behavior-based savings. From a resource planning perspective, they need to know how much energy behavioral changes can save and how persistent those savings will be. Energy providers already know that behavior is having an impact on energy demand and energy savings, but *they often treat the impact as if it were zero* because they have insufficient information and evidence documenting the actual impacts. Additional research is clearly needed to review and assess existing studies in a manner that looks across studies to extract lessons and patterns, providing reliable estimates regarding the size and reliability of behavior-related savings. This type of information would allow utilities to plan more effectively and improve their ability to forestall or eliminate investments in additional power plants.

While adequate planning clearly requires more research and more information, the allocation of funds to behavior-related projects is also constrained by limitations in the overall availability of funding and the need to choose between alternative programs, projects and policies. In other words, the short-term and long-term energy saving potential of behavior-oriented programs and policies must be compared with investments in other types of activities. And unfortunately, decision-makers generally rely on a less-than-perfect system of attributing energy savings to specific policies and programs. An important implication is that behavior-oriented programs are often short changed because programs frequently overemphasize the savings that are attributable to the installation of new technologies but often underemphasize the ways in which behavior enables technology-based savings. (A more complete description can be found in the forthcoming CPUC white paper on pursuing behavior-based strategies in a regulatory environment [Ehrhardt-Martinez and Laitner 2009].)

Recently, however, growing concerns over climate change and rapidly rising energy prices have brought new attention to behavioral approaches and the largely untapped potential that they offer in reducing overall levels of energy consumption. In the field of behavior-based policy strategies, policy-makers and program managers alike are attempting to assess how energy prices and climate change might motivate new patterns of reduced energy consumption. For example, in a recent assessment of popular concern over climate change and its ability to accelerate the adoption of energy-efficient technologies and behaviors in the Pacific Northwest, Drury (2008) concludes that it would be efficacious to "deliberately join energy efficiency with climate change." According to the report, "Linking climate change to energy efficiency solutions is powerful." And joining the two should result in increased energy savings. Moreover, the combination of high prices and concerns over global climate change have resulted in innovative new approaches geared toward providing the means and mechanisms by which those who have become motivated to act can translate their new concerns into long-term, beneficial behaviors. For example, both policymakers and business leaders are increasingly likely to consider the potential benefits of using carbon labels, social norms, and insights from behavioral economics to shape long-term consumer, household and business behaviors. Importantly, these innovative, new approaches to behavior change may help increase both our

understanding of the potential contributions of behavior-based approaches and the reliability of these approaches. For more information see Lutzenhiser (2007), Tiedemann (2007), Rodrigues (2007), and Clinton (2007) under BECC Conference Presentation References.

A. Energy Modeling and Energy Policy

Behind every energy policy model and every legislative proposal is a set of assumptions about how organizations and individuals behave and change. Unfortunately, current mainstream energy models fail to adequately integrate the potential energy savings associated with behavior-based policy interventions and changing preferences. As a result, most energy policy decisions are currently made under false assumptions and severely underestimate the potential benefits of behavior-based programs while overestimating the implied costs of proposed greenhouse gas (GHG) emissions reduction programs. In the end, these biased assumptions reduce the viable policy options available to political and economic decision makers and forestall advances in making real reductions in GHG emissions.

Fortunately, some efforts have been instigated to address the shortcomings of mainstream models. At the BECC Conference three presentations specifically focused on improving economic policy models by questioning oft-held assumptions, exploring alternative theoretical frameworks, and exploring the potential policy implications of shifts in model results.

For example, the work of Skip Laitner (ACEEE) seeks to improve upon standard economic policy models through the integration of a measure of consumer preferences. Instead of assuming that preferences are fixed, Laitner's approach recognizes that the adoption and utilization of technology often reflects changes in preferences, levels of awareness, and social norms. Among the implications of these changes is that energy efficiency cannot accurately be modeled as a function of energy prices and consumer income alone but must also reflect what Laitner calls the "price/preference ratio". In other words, a particular technology may become more or less attractive without a change in price or income as a result of a shift in context, circumstances or policy environment. Models that fail to account for changing preferences will continue to systematically underestimate potential policy impacts and narrow the range of choices available to policymakers. Ultimately, traditional approaches to modeling behavior tend to overestimate the costs of reducing energy consumption and underestimate the economic and employment benefits.

Unlike traditional models, Laitner's approach takes into account the dynamic way in which more efficient and productive technologies can *substitute for* energy inputs. When modeled correctly, behavioral change and increased energy productivity cannot only reduce energy consumption, they can also *enhance* the robustness of the economy, and *expand* employment. Accordingly, the economic impact of reducing U.S. energy demand depends on four core variables: consumer preferences, the size of the value-added contributions from the non-energy sectors, the labor intensity of these sectors, and the assumed cost-effectiveness of the many energy-efficient technologies which might be deployed. This has important implications for policymakers because, while most energy models assume that efforts to reduce energy consumption imply a net cost to the economy. However, by integrating non-economic drivers of behavior, and the cost savings associated with more energy efficient technologies, Laitner argues that the right mix of well-designed programs and policies could, in fact, result in a series of small but net positive impacts on GDP and on the nation's employment base (Laitner and McKinney 2008). For more information see Laitner (2007) under BECC Conference Presentation References.

Marvin Horowitz also emphasizes that policy models and energy policies need to better account for and represent consumer behavior and their changing tastes and preferences in order to increase the accuracy of existing models and the effectiveness of new and existing policies. Nevertheless, the real

focus of future research should be on assessing why and how people do what they do with regard to energy use. In order to accomplish the needed research, Horowitz advocates for the establishment of a National Energy Efficiency Data Center that would collect and study data on energy efficiency and behavior. Unfortunately, according to Horowitz, "the energy efficiency industry has not even begun to scratch the surface of doing the kinds of studies that will be of long-run benefit to the public" (Horowitz 2007).

Horowitz's approach is based on partial-equilibrium economic models, which he uses to explore changes in energy-related investments. According to his approach, efficiency investments are the result of two factors: 1) fixed behaviors that don't change in response to changing energy costs, and 2) people's malleable propensity to adopt new, more energy-efficient technologies sooner rather than later (as a function of the present value of energy bills). Once behavior is framed in this way, three research questions emerge:

1. How much of an impact is provided by fixed behaviors as opposed to price-sensitive behaviors?
2. What factors determine the predominance of fixed behaviors or price-sensitive behaviors in determining technology adoption?
3. Are the relative contributions of each fixed or can they change? (Why are they permanent or why would they change?)

Importantly, this approach suggests that the preferences and tastes of individuals determine the magnitude or relative importance of both fixed behaviors and price-sensitive behaviors. Some of these factors include (1) familiarity, information, advertising, and promotion, (2) physical and/or mental addiction, and (3) public policies. As such, *what really needs to be studied are the ways in which energy efficiency programs can be used to change tastes and expectations.* Unfortunately most programs fail to consider these questions and instead are more likely to focus on traditional market transformation approaches to technology adoption and evaluation. Moreover, at this time, program evaluation data tend to be fragmented across utilities, preventing most attempts to study the phenomenon using comparative research. For more information see Horowitz (2007) under BECC Conference Presentation References.

The third presentation, by Charlie Wilson (Institute for Resources, Environment and Sustainability, University of British Columbia), seeks to improve upon our understanding of economic decision-making by assessing non-economic approaches and insights. His review of decision models from across the social sciences reveals four important insights:

1. Behavior is not all thoughtful or instrumental.
2. Context matters; behavior is often constrained.
3. Habits, routines, and norms all shape energy use and resist changes in price/information.
4. People are different.

Like Laitner and Horowitz, Wilson recognizes the importance of preferences in decision-making, but his focus is on (a) how we assess alternatives, (b) how we actually choose, (c) the importance of context, and (d) the variation among people or groups of people. According to his research, a variety of factors influence how we assess alternatives — from the way in which choices are framed, to the reference points provided, to human fallibility. In general, people tend to be loss averse and will avoid choices that imply certain loss. Reference points also shape decisions as they often serve as benchmarks or anchors to which choices become relative. For example, research indicates that just removing the default temperature settings on washing machines reduces energy use by 24%.

Research on how most people actually make choices indicates that people are clearly not just optimizers. Instead people are likely to use heuristics other than utility maximization in making decisions and emotions often play an important role, particularly when information is not readily available. Moreover, behaviors often result from the lack of decision-making. In these cases energy-using behaviors are best described as habitual or patterned and may appear to be resistant to changes in price. These types of behaviors require commitments, feedback, and other forms of support to change.

The translation of attitudes and preferences into behavior must also take into account the contextual variables that shape and constrain the potential influence of positive attitudes. For example, recent research indicates that the implementation of energy efficient renovations was less closely tied to attitudes and intentions than it was to house age, size, condition, and household composition. In this example, the decision to renovate and the energy implications of those decisions were shaped in significant ways by preexisting social and technical systems.

Finally, it is also important to recognize that people, households, and lifestyles vary in significant ways and that these variations are important in determining energy consumption patterns and decision- making behaviors. Whether we consider lifecycle stages, income, housing type, ethnicity or other factors, it is important to recognize that individuals and households are not all alike and our models should reflect that variation. In addition people have different values and personalities and some people are more likely to be early adopters while others are only likely to adopt proven technologies.

Together, these three presentations effectively illustrated the importance of understanding and accounting for preferences in energy consumption models. In general we need to do a better job of incorporating behavior into energy models, of understanding how preferences shape price elasticities and how they work independently from price elasticities to shape energy consumption decision. Finally, we need to do a better job at recognizing and understanding the non-economic mechanisms that shape and constrain energy-related decisions. For more information see Wilson (2007) under BECC Conference Presentation References.

B. Using Social Science, Public Opinion Research and Media to Build on Global Warming Science.

Public support for national, state, and city-level policies and initiatives aimed at reducing the impacts of global climate change can be strengthened by drawing lessons from (and supporting the development of) a growing body of social science research. From measures of public opinion, to efforts to understand decision making and social movements, the social sciences can provide a variety of effective approaches for both understanding and shaping the public's perceptions of climate change and the public's willingness to act to reduce our nation's impact on the global climate. In other words, the social sciences can provide the necessary tools and frameworks for revealing the causal linkages between human behavior and environmental outcomes and for improving our understanding of the human dimensions of energy consumption, energy conservation, and climate change. Importantly, whereas the problem of climate change might be best defined in terms of the biophysical changes in the earth's environment, the solutions to climate change lie in the social realm, particularly in a better understanding of human behavior and the ways in which culture and social structure shape and constrain our preferences, lifestyles, and politics, as well as our propensity to adopt lower impact technologies.

Several of the BECC Conference presentations provided valuable insights on the opinions, attitudes and preferences of individuals with regard to climate change and how they might translate into

climate-positive actions. These presentations focused on the important ways in which public opinion has changed over the past ten years, the differences between national-level and state-level opinion trends, and the ways in which culture and values shape individual perceptions and decisions.

Public opinion. According to Jon Krosnick's historical assessment of public opinion, for example, the level of popular concern over climate change during the past ten years has appeared to remain relatively high and steady. But aggregate statistics can be deceiving. While aggregate-level opinions haven't changed much, the same national polls indicate that attitudes have become more politicized, particularly with regard to possible solutions to climate change. For example, in both 1997 and 2007, more than 75% of people agreed that climate change was indeed happening. However by 2007 the gap between democrats and republicans had grown to 20% with 93% of democrats agreeing that global climate change was occurring but only 73% of republicans. A similar gap existed between the parties with regard to the need for climate change regulation.

Despite the high level of concern at the national level, wide-spread support for climate change regulation has been lacking. At least in part, this lack of support is due to disagreement about the most likely causes and the most sensible solutions to climate change. In order to formulate a national-level strategy, not only must a large proportion of the public be able to recognize the problem but they must also agree that the trend is something that is bad for the nation's people, that people are in fact the cause of the problem, and that by taking action we can solve it. When these questions are considered, the lack of national policy appears less surprising.

For example, in 1997 polling results indicated that while more than 75% of people believed that global warming was occurring, only 63% thought that it would have a predominantly negative effect on our society. There were even more important differences of opinion when it came to the level of effort that should be given to climate change, and how much respondents thought was being done to resolve climate change. Despite these discrepancies, recent polls indicate that more and more people believe that climate change presents real threats to our society and that people are causing the problem.

A significant part of the split between democrats and republicans seems to be grounded in the public's incorrect perception that there is a great deal of debate and disagreement within the scientific community about various aspects of global climate change. Among the causes cited for the public's misperceptions is the media's pursuit of "balanced" news stories that give equal weight to opposing perspectives on a particular issue (Koomey et al. 2002).

Also of critical importance is the need to recognize that the opinions, attitudes, and beliefs of certain segments of the population are more politically significant than those of others. Among the most important groups are those people who make up what has been dubbed "the issue public" or "the small fraction of the population that is passionate about the issue." For global warming, the issue public has more than doubled since 1997 from 8% to 18% of the population. Finally, it is important to recognize that concern over *g*lobal climate change varies regionally, and the pacific U.S. is the area in which more people are engaged in addressing this issue.

In terms of specific policies, Americans have expressed the most support for government efforts to encourage changes in business practices through the use of tax breaks as well as the implementation of government standards on fuel efficiency. Less support was found for carbon taxes and the least support was found for cap-and-trade systems. Costs are also an important consideration. Generally, as the cost of particular efforts increases, the level of policy support across all policy types declines. For more information see Krosnick (2007) under BECC Conference Presentation References.

Public opinion in California. At the state level, Mark DiCamillo's research on attitudes toward climate change held by adults in California provides similar insights that can be used to both inform policy and media campaigns. DiCamillo's research found that people with higher levels of education tended to be more aware of climate change issues and that Californians are twice as likely as the national average to say that global warming is extremely important to them. Similarly, more Californians report that global warming requires immediate action (43% versus 34% nationally) and the vast majority (82%) view global warming as a serious threat to their overall quality of life.

In terms of solutions, more than 80% of Californians believe that the state can do a lot to reduce global warming and grow the economy at the same time. Similarly, approximately 90% of respondents felt that California can be a leader in new technologies aimed at improving energy efficiency. As opposed to support for government action, however, the private sector was identified more often as the best vehicle for addressing global warming and tax credits were seen as the best mechanism. Finally, Californians were generally more supportive of cap and trade approaches than the nation as a whole and carbon taxes were the least popular mechanism among California adults. For more information see DiCamillo (2007) under BECC Conference Presentation References.

Attitudes, opinions and value systems. Finally, while socio-demographic variations can be telling, Bill Guns work explores the ways in which attitudes, opinions and behaviors are shaped by value systems. According to Guns' experience, this type of segmentation research is very important because it allows the researcher to reach beyond age, demographics and income which tend to be poor indicators of environmental technology adoption. Instead, the system used by Guns (called the VALS system) focuses on identifying the answers to two primary questions:

1. What is the individual's motivation? (These are enduring factors that transcend age, gender, income, and geography), and
2. What emotional and psychological resources does this individual have to express their motivation?

In terms of motivation, individuals generally fit into one of three categories based on the underlying way in which they make decisions. These psychographic groups include: 1) those who are motivated by ideals, principles and beliefs; 2) those who are motivated by achievement; and 3) those who are motivated by self expression. The second dimension measures the resources that individuals have access to for the realization and/or expression of their motivations. These resources may include any combination of emotional, psychological and physical resources.

By looking at both motivation and resources, individuals can be understood as belonging to one of eight specific segments. In terms of energy use, carbon emissions and behavior, this type of information is invaluable for understanding how different groups of people might think about specific policies and standards as well as how likely people are to change their behavior voluntarily. At a very basic level, it begins with an understanding of how different people interpret the word "environment". For example, is the environment perceived as something local, everyday and mundane or is it an exotic vacation destination? The basic premise behind this approach is that different motivation models will lead to different forms of personal action and will also influence the degree to which different types of appeals will affect any particular group. When faced with a decision, people who are motivated by achievement want to know what others are doing, while people who are motivated by self expression are more concerned with doing what they feels like doing. Finally, people who are motivated by ideals tend to be focused on what they and others "should' be doing.

According to Guns, measures of psychological motivations tend to be much better predictors of decisions than age, gender and other socio-demographic measures, particularly once available

resources are also taken into account. An assessment of individual resources in conjunction with motivations, allows for a more complete assessment of likely behaviors. Gaining these insights allows for more successful communications, because it helps frame the message in a way that accounts for the particular knowledge and resources of different audiences, the media that they are likely to access and pay attention to, and the types of incentives that they are likely to find appealing.

According to Guns, it is important to recognize that the diverse public to whom our communications efforts are aimed is more limited in terms of resources than we might initially believe. For example, while most communications are high level and abstract, only 10-25% of adults comprehend sophisticated messages. Similarly, only 49% of American's bought even a single book last year, and less than 10% of Americans ever attend meetings or write opinions.

In terms of climate marketing specifically, most people are tuning out. Most people aren't listening, and when they are what they learn is unlikely to change behavior. In other words, the most successful approaches to global climate change won't simply rely on sharing information about the problem and/or voluntary actions. Instead efforts to address global climate change will require targeted efforts to motivate different types of people with access to different sets of resources.

As exemplified by each of these approaches, policy and political action can benefit greatly when informed by social science research and other insights gained through opinion polling and other research methods. Politicians and advocacy groups can use information from public opinion polls, social scientists, and experts in communications to effectively make the case that global climate change is an issue that requires immediate and broad policy-level action. For more information see Guns (2007) under BECC Conference Presentation References.

C. Choice Points, Choice Architecture and Trade Allies

In response to a request by the US EPA and the National Science Foundation to identify areas in which concentrated new research efforts could both advance the environmental and social sciences and contribute to improved decisions affecting environmental quality, in 2005 the National Research Council highlighted the importance of individuals and households in terms of their aggregate impact on the environment. Among other evidence, the study points out that consumer expenditures currently account for approximately two-thirds of gross domestic product and that households directly account for just under half of U.S. carbon emissions (NRC 2005: 69). Importantly, individual behaviors were recognized as having a "significant direct impact in the aggregate in the areas of transportation, housing, energy-using appliances, solid waste, water, and food" (NRC 2005: 70). This evidence suggests that consumer decisions are clearly playing a large role in shaping individual and household level impacts on the environment. Interestingly, however, while existing research has been successful in documenting high and growing levels of environmental concern among the public, measures of consumer practices have documented the reverse — increasing levels of environmental impact from consumers who more frequently choose to buy larger homes and gas guzzling motor vehicles. While this paradox has yet to be explained, researchers in the field of behavioral economics, energy efficiency, and energy policy have converged on the importance of consumer choices, choice structures, and choice facilitators as important elements in explaining the gap between attitudes and behaviors. These topics were emphasized in the conference session on "Lessons from 30 Years of Energy Efficiency Program Implementation" by Jane Peters as well as the session on education and voluntary actions by Paul Stern and they resurfaced in a variety of other sessions and discussions throughout the conference. For more information see Peters (2007) and Stern (2007) under BECC Conference Presentation References.

When it comes to choices in housing, transportation, and appliances, the environmental impact of a single consumer choice can resound for years or even decades into the future. Yet, due to the infrequency of these types of choices in people's lives, individuals are less likely to be adequately informed and therefore less likely to understand the energy implications of these decisions when faced with making a choice. According to Thaler and Sunstein (2008) it is precisely in these types of situations that choice architecture matters the most. In other words, people tend to make good choices in those "contexts in which they have experience, good information and prompt feedback … and less well in contexts in which they are inexperienced and poorly informed, and in which feedback is slow or infrequent" (2008: 9). In these instances in which people are making less than perfect choices, people are likely to benefit from some help and that help can be provided through the use of a smarter choice architecture. To put it simply, choice architecture is simply about designing, organizing, and structuring the context in which people make decisions so as to help them achieve the most favorable outcome. By doing so, "choice architects can make major improvements to the lives of others by designing user-friendly environments" (2008: 11).

In terms of energy and climate change, consumers lack proper incentives for reducing their energy consumption because most of the environmental costs are externalized. This problem is compounded by the lack of regular feedback that might readily demonstrate the environmental consequences of specific actions. Thaler and Sunstein advocate a variety of different types of nudges to reduce carbon emissions, including the development of a Greenhouse Gas Inventory that would require disclosure by "the most significant emitters," and in-house energy monitoring devices that can provide people with immediate visual feedback concerning their energy use. Several types of feedback devices currently exist and they are the focus of increasing attention by utilities and automakers who are exploring ways to help consumers increase their level of awareness and limit their own energy consumption through smarter energy use practices.

Other types of nudges could also be made within the market transformations initiative. In this case, program implementers are more likely to focus on the role of intermediary actors such as plumbers, HVAC contractors, realtors, car dealers, appliance retailers, and others who also play a significant role in structuring consumer choices. By providing adequate information and incentives to trade allies and other intermediary actors, they are better able to help consumers understand the long-term implications of the purchasing decisions and to choose wisely.

D. Pay-As-You-Drive Climate Insurance

As long as the U.S. and the world continue to rely on fossil fuels as our primary source of energy, declining energy reserves and burgeoning carbon emissions are likely to become an ever dominant national and global policy concern. For the U.S. an even more pressing concern is our continued reliance on foreign petroleum reserves. Given the dramatic increase in world oil prices, reducing our consumption of petroleum products should clearly be among the top U.S. energy policy priorities. Interestingly, nearly three quarters (72%) of all gasoline and diesel products consumed in the U.S. are used to fuel light duty vehicles. As such, it is clear that transportation-related behavior offers real potential for large-scale energy savings. Between 1970 and 2007, U.S. consumption of motor gasoline increase 79% from roughly 7.8 million barrels per day to over 13.9 million barrels per day. Between 1970 and 2006 average fuel economy increase from 13.5 to 22.4 miles per gallon and the total vehicle miles traveled increased by 83% from 917 billion miles to 1.68 trillion miles (DOE 2008).

Real federal and state policies are needed to change transportation behaviors and to enable other national-level and state-level policies aimed at reducing our dependence on foreign sources of oil, not to mention contribute to climate change solutions. Pay-as-You-Drive Climate Insurance is a low-

cost, progressive policy that can help us to achieve a significant shift in transportation-related behavioral patterns and reduce our consumption of petroleum. Pay-as-You-Drive insurance would allow insurance costs to vary according to the number of miles driven, providing people with new incentives to drive less. According to economic assessments by the Brooking Institution, gasoline consumption is likely to fall by between 6.5 and 10% as a result. Similarly, the decline in traffic accidents, congestion and air pollution would result in social benefits estimated at $30 billion per year. And two-thirds of drivers would actually pay less for their annual car insurance. Moreover, since income levels and annual vehicle miles traveled are highly correlated, most people with low-incomes are likely to experience declines in their auto insurance rates (Bordoff and Noel 2008).

A first step toward achieving these numerous benefits is the establishment of state legislation to allow for this type of insurance as well as pilot programs that would "encourage states and develop better data on consumer benefits and effects on driving behavior." These types of programs would also benefit from targeted, behavior-oriented programs aimed at facilitating behavioral change via a variety of social mechanisms and programs to reduce personal constraints and bolster personal capabilities.

E. Standards, Regulations and Voluntary Measures: Internalizing Environmental Costs and Enabling Actors

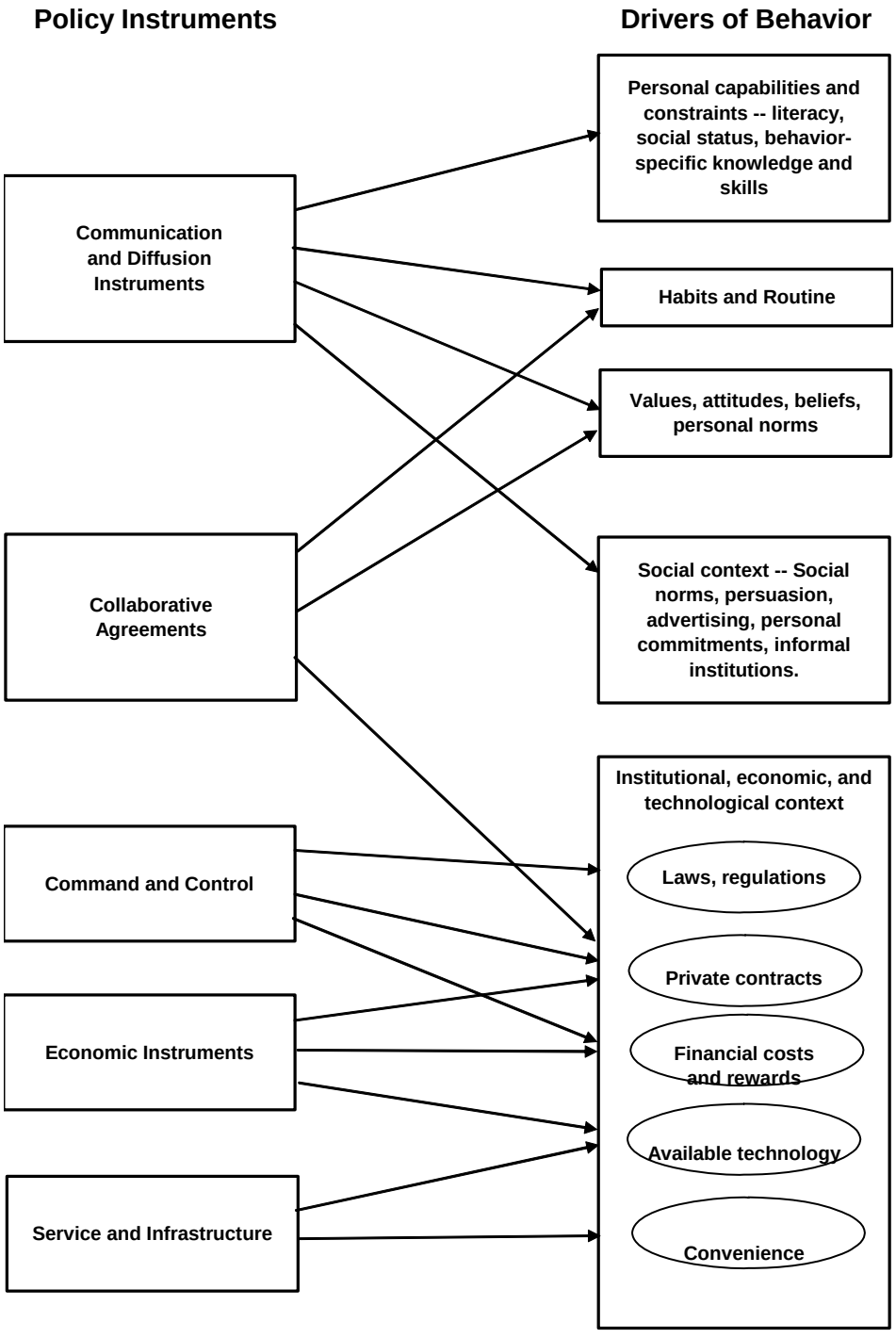
Although policymakers have many policy instruments at their disposal, they are not all equally effective in changing the drivers of energy use behavior. As such, it is important to consider which policy instruments should be used (either alone or in combination) to overcome barriers, to internalize environmental costs, and to motivate and enable individuals, households and businesses to act in more environmentally sustainable ways. Some of the most common policy approaches provide both direct and indirect means of reducing energy use and carbon dioxide emissions. For example, both product efficiency standards and government regulations that limit carbon dioxide emissions can be used to set limits on the energy intensity of common technologies or limit the amount of carbon emissions that are deemed acceptable or legal. In addition, voluntary programs that utilize collaborative agreements as well as communications and diffusion instruments can be implemented to overcome limitations in personal capabilities and constraints, as well as established habits and routines, or incompatible values, attitudes, beliefs and social norms (Stern 2002: 202).

Which policy options are the most effective at internalizing environmental costs and enabling and empowering actors? In a review of various policy instruments, Stern (2002) points out that the choice of policy options should always consciously identify and take into account the particular barriers that are standing in the way of achieving a specific target behavior because any particular policy instrument could either be highly successful or nearly useless depending on both the context as well as the behavior in question. In addition, according to Stern, "each type of policy instrument has particular capabilities and thus can influence only a subset of the many factors that drive behavior." While some policy instruments are more effective in addressing personal capabilities and constraints, for example, others are likely to prove more effective in addressing the broader social, economic or technological contexts within which people establish habits and lifestyles and make decisions regarding their own behavior.

Figure 2 (borrowed from Stern 2002: 203) identifies the various drivers of environmentally significant behavior and maps the relationships between the drivers and specific policy instruments. Mapping these relationships provides some valuable insights into the likely effectiveness of policy strategies aimed at reducing energy use and achieving climate change goals. As indicated in Figure 2, communication and diffusion instruments are likely to be most effective in overcoming personal constraints as well as unfavorable habits and routines and for bolstering personal capabilities.

Figure 2: Policy and Behavior

Paths of Influence of Five Types of Environmental Policy Instruments



Source: Stern 2002: 203

However, these same instruments "cannot make inconvenient behaviors convenient, make expensive behaviors inexpensive, or remove institutional or legal barriers to behavioral change. They often cannot even get people to put environmental actions high enough on the personal to-do lists to get them done, even if they are convinced to act." (Stern 2002: 202) On the other hand, when behavioral change is hindered by a lack of information, social support, behavioral models and other similar-scale means of facilitating change, then the sole use of regulatory and economic instruments is also likely to be relatively ineffective in bringing about desired change. According to Stern, interventions are most effective when they combine various types of communication and diffusion instruments with each other and with other types of policy instruments.

As such, behavioral approaches might best be thought of as achieving change via two different paths: (1) as an enabler of a wide variety of policy and economic instruments (whereby the use of behavior approaches significantly amplifies the effectiveness of macro-level policy and economic instruments), and (2) as a stand alone means of addressing those circumstances in which the only important barriers are those associated with a lack of information, social support, behavioral models, and other aspects of an individual's immediate social context. Regardless, the important message here is that behavioral programs are important to all types of efforts aimed at achieving environmental sustainability, whether as an enabling mechanism that can expand the reach of laws, regulations and financial incentives or as an independent means of achieving behavioral change. In general, behavioral programs are essential to the success of all types of policy instruments whether they are attempting to create behavioral change directly or indirectly. Given the shift away from behavior-oriented approaches during the past 20-25 years, greater emphasis and effort need to be given to expand the development of programs that focus on or integrate behavioral approaches. For more information see Stern (2007) under BECC Conference Presentation References.

VI. PROGRAM INNOVATIONS

A. Public Health Initiatives and Health Promotion Interventions

These have been used successfully to address a variety of public health issues. These types of initiatives could be adapted to address a variety of social problems including energy consumption, environmental degradation and climate change. Importantly, public health initiatives and other types of interventions can occur at multiple levels within our social environment, from those that involve interpersonal communications to those that involve the media, public policy and changes in the built environment.[3] Armel and Ryerson focused on two of these levels: interpersonal and socio-cultural media-based approaches.

The approach used by the Population Media Center uses entertainment broadcasting to model desired behaviors, motivate behavioral change, provide information regarding achieving desired behaviors, and establish more favorable social norms. This approach uses methodology that is based on five different theories of communication and behavior change: (a) a circular adaptation of Shannon and Weaver's Communication Model, (b) Bentley's Dramatic Theory, (c) Jung's Theory of Archetypes and Stereotypes and the Collective Unconscious, (d) the Social Learning Theory of Albert Bandura, and (e) MacLean's Concept of the Triune Brain, supplemented by Sabido's own Theory of the Tone. (More information on these theories is available on the Population Media Center Web site at http://www.populationmedia.org/what/theoretical-framework.)

[3] As explained by Armel, program interventions can occur at multiple levels: interpersonal (involving face-to-face contact), socio-cultural (including media communications), policy (including municipal, state, regional, national and international policies), and physical environment (including changes in the technologies, buildings, and transportation systems).

Social learning theory is one of the essential foundations of this approach. The theory is rooted in the idea that people can learn new behaviors by vicariously experiencing the actions of other people. Serial dramas use this practice of "modeling" behaviors that are both desirable and undesirable. The audience witnesses that desirable behaviors are visibly rewarded while undesirable behaviors are visibly punished. Generally the program seeks to influence viewers in a way that transforms the values being promoted by the program into appropriate behaviors on the part of the audience. The audience learns the lessons vicariously by observing the actions of the program characters and the consequences that befall them.

The Population Media Center applies this method of behavioral change to address issues related to population growth and public health in fifteen (primarily less-developed) countries around the world. However, Bill Ryerson (President of the Population Media Center) sees important linkages between population growth, poverty, hunger and energy demand, especially as fossil fuel reserves decline and we must look to agricultural crops as an energy source. Importantly, the Population Media Center has successful applied this method of behavioral change through the use of mass media outlets such as radio and television, reaching broad audiences and helping large numbers of people to rethink their own behavior. For example, Radio Tanzania used the method in a two-year campaign to reduce HIV infection. An evaluation of the project revealed that 82% of listeners reported that the program had caused them to change their HIV behavior by limiting partners and using condoms. There was also a 153% increase in condom distribution in broadcast areas (compared to a 16% increase in a control site), and an increase of 10% of married women using family planning. A similar program in Ethiopia found that 63% of new reproductive health clients said they listed to the programs, while the percent of married women using family planning increased from 24 to 79%.

In the U.S. this type of approach could use other mass media outlets such as the internet to convey information about the link between behavior and climate change.

The success of the entertainment-based approaches employed by the Population Media Center relies on a well-researched and sophisticated methodology that requires knowledge of the audience, the media, and the local resources. PMC uses sophisticated audience research methods and multiple media sources. They focus their efforts on groups with the highest need, support local producers and writers to create indigenous programs, and work with national and local broadcasters to air locally-produced programs. Among the important components of the program, PMC starts by identifying cultural issues and established attitudes that currently affect decision making about the issue in question. They must also assess the barriers and opportunities for effectively using the mass media to effectively address the issue and then develop an approach that is as collaborative as possible.

Other public health interventions involve one or more approaches that seek to shape individual behavior by addressing motivation and barriers at several levels. In fact, complementary interventions that work at multiple levels are generally seen as being the most effective in bringing about behavior change such that implementing carbon policies alone will be less effective than implementing these policies in conjunction with interpersonal and media-based efforts. For more information see Ryerson (2007) under BECC Conference Presentation References.

Carrie Armel is currently working with Tom Robinson, a health promotion researcher at Stanford University, on an intervention to promote climate-positive behavior. The intervention will be based on a theory of behavior change that utilizes the core elements from several different sources including: Learning Theory, Social Cognitive Theory, Cognitive Behavioral Therapy, and Community Based Social Marketing. Importantly, Armel's approach is rooted in understanding the relationship between motivation, behavior, outcome and feedback.

Of particular importance are the notions that (1) strong motivation and self-efficacy are required to generate behavior change, (2) long-term behavioral change requires that individuals link their behavior to a particular outcome or "learn" the implications of their actions; and (3) frequent feedback about specific behaviors can greatly enhance the achievement of desired behaviors. In other words, long-term behavioral change requires that actors are motivated and self-confident in their ability to achieve their desired goals, and that individuals are given effective means to learn about the implications of their actions. Given the importance of these elements, this intervention approach seeks to address these issues by:

- Identifying external and internal motivators and linking them to behaviors
- Addressing potential barriers to enactment
- Setting goals and encouraging new skills and habits
- Providing feedback to individuals and groups regarding their progress

As implied by the above list, the effectiveness of interventions is dependent on their ability to focus on, and specifically address, the barriers, goals, outcomes, and motivations associated with specific behaviors. As such, this type of approach requires the targeting of specific behaviors as opposed to a broad set of issue-related behaviors.

This approach also recognizes that learning can be facilitated in a variety of ways using techniques that are among those currently used in public health initiatives, including providing individuals with information or persuading arguments/viewpoints (as with a PSA); allowing individuals to observe others go through the processes (as with the use of serial dramas); and through activities that allow individuals to enact the desired behavior. Finally, frequent, targeted feedback is an important means of reinforcing behaviors and providing individuals with specific information about their efforts. In a review of 38 studies of energy-efficiency, feedback was found to reduce energy usage by 10-14% on average (Darby 2006). For more information see Armel (2007) under BECC Conference Presentation References.

B. Social Norms, Feedback and Persuasion Theory

Another approach to behavioral change focuses more closely on the ways in which individuals use the behavior of others as a means of determining what behavior they should or shouldn't adopt in a given situation. This approach focuses on individuals as social actors who look to others to determine what are the most "appropriate" ways of behaving in a particular context. In other words, individuals tend to mold their own behavior in ways that conform with what other people (who are similar to themselves) are doing in the same context. If an individual observes or otherwise knows that a lot of people like him/her are taking a particular action, they are more likely to take the same action as a function of this knowledge. In this instance, the adoption of the new behavior is facilitated through the discovery and use of social norms that give us cues as to what is considered "socially appropriate" behavior.

According to Robert Cialdini, we can use a norms-based approach to advance specific conservation goals by letting people know the actual conservation efforts of their neighbors since these efforts are generally underestimated. The approach is likely to be even more effective if the information provided to individuals is even more tailored so as to reflect the norms of people who are similar to them in additional ways. In other words, if people are given information about their neighbors who are similar to themselves, they are more likely to change their behavior than if given information regarding the neighborhood as a whole.

Interestingly, Cialdini's work suggests that social norms can be more important than economic incentives in bringing about behavioral change. In one experiment, he compared participation rates in a hotel program that attempted to get guests to reuse their towels rather than have them laundered each day. In that instance, guests weren't any more likely to reuse their towels when told that the hotel would donate a portion of the energy savings to a nonprofit environmental organization. However, when the individuals were told that nearly 75% of guests participated in the program, the rate of towel reuse increase by 39 to 48%. Moreover when guests were told that the majority of guests who stayed in their particular room had recycled their towels, the rate of towel reuse increased by 48 to 54%.

While this approach has proven effective in a variety of situations, it is important to keep in mind that it requires the ability to collect, tailor and deliver information regarding normative behavior. Individuals need to know what other people like them are doing with regard to the issue in question. In terms of residential energy consumption, individuals also need to have information updated regularly, so they know how much progress they are making and how their progress compares to that of others. Finally, behavioral change can be facilitated by providing households with insights into what they can do that will help them to be effective in meeting their goals of reduced energy consumption. Certain types of tools can help households monitor and evaluate their own energy consumption, compare their consumption to others like them, identify ways in which they might change their behavior, and take action. Positive Energy is working toward these ends through the use of home energy reports, individualized Web sites and data warehousing and mining. Through these mechanisms, households are able to assess their energy usage compared to others as well as their own historical consumption patterns. For more information see Cialdini (2007) under BECC Conference Presentation References.

C. Social Networks, Diffusion, Commitments and New Technologies

Some programs are reassessing how social networks can be used to facilitate the diffusion of new ideas, technologies, and behaviors throughout the population. These programs are based on an understanding of the social ties that link each of us, either directly or indirectly, to a wide range of other people. In their aggregate, these social ties constitute our social network or those individuals with whom we interact with on a regular basis. The basic idea behind network-based approaches is to consciously tap into existing networks, in order to accelerate the spread of ideas, technologies and behaviors. Since friends, family, and colleagues are much more likely to listen to information when it comes from someone they know, existing social networks are likely to facilitate the dissemination of new ideas. They also increase the likelihood that individuals will commit to a course of action that they might not otherwise find compelling. Finally, social networks are increasingly important because new technologies such as the internet and cell phones have greatly facilitated communications between network actors.

Based in Ottawa, Canada, One Change is a nonprofit organization that uses social networks to distribute compact fluorescent light bulbs and encourage households to change their behaviors in ways that are more sustainable. Their approach recognizes that global climate change is such a large problem that many people feel overwhelmed by its scale and feel disempowered to make a difference. One Change provides individuals with the means to work within existing communities to help people take simple actions that, in their aggregate, have a larger impact. The organization also provides the means for individuals to observe the scope of change that communities can make by tracking their impact using an online mapping system.

The project gets volunteers to sign–up at a variety of local events, community meetings and on the organization's Web site. Volunteers then go door to door distributing one CFL to each household

along with a card that provides conservation information. Recipients are asked to commit to replacing one incandescent light bulb with the CFL. Volunteers keep track of the houses that they visit which are then accounted for on an online map that shows which streets and homes have received free bulbs. So far the group has given away more than a million light bulbs through their work with utilities, more than 60 community groups, 35 municipal partners and 3200 volunteers.

An evaluation of their efforts has shown that awareness and use of CFLs has increased significantly. Approximately 70% of people who receive CFLs through the program install the bulb immediately and recipients are more likely to buy other energy efficient appliances. Moreover, Ottawa has the highest penetration rate of CFLs in the country. For more information see Hickox (2007) under BECC Conference Presentation References.

Other efforts seek to leverage social networks using existing online social networking Web sites. For example, Jennifer Mankoff and others from the Carnegie-Mellon's Human-Computer Interaction Institute are designing an online intervention that brings together a variety of online resources to reach a larger group of people than might otherwise be readily accessible. The new effort, called Step Green, is specifically focused on using internet-based networks to bring about social change. According to the group's research, 73% of adults and 86% of households with incomes over $50,000 currently use the internet. Moreover, social networking sites reach approximately 45% of all Web users and an even higher percentage of young users. In fact, younger and more financially secure households are precisely those that Mankoff's group believes are most likely to invest in the needed changes to increase energy efficiency.

The group's ongoing research seeks to answer five questions:

1. What are the barriers and opportunities for online social networks to support reduced individual energy consumption?
2. What types of motivation will be most effective?
3. How does the effectiveness of motivation change as group size, deployment length and participation grow?
4. What role does social capital play in motivation? And
5. Will online social networks have a structural impact on green behavior (e.g., socializing people to the issue, distributing information)?

So far the group has developed a set of actionable suggestions for behavior change and surveyed the online community to gauge their willingness to change behaviors. According to their survey the behaviors that people were most willing to change included turning off lights, washing full loads of dishes, combining car trips, adjusting thermostat, unplugging electronics, washing laundry in cold water, turning down the water heater, taking shorter showers, and reducing the amount of meat in their diet. The least popular where carpooling and air drying their clothes. Overall, women were more interested than men in taking action. However, further research is needed to assess the success of the program in creating behavioral change. For more information see Mankoff and Fussell (2007) under BECC Conference Presentation References.

Two other important social networking systems have also been actively involved in the dissemination of energy efficiency and climate change information. Reverend Dexter McNamara, the Executive Director, of the Interfaith Services Bureau, and Crystal Durham, the Executive Director of the California Student Sustainability Coalition spoke on the role of networks within religious and educational institutions. McNamara adds to the network discussion by suggesting that there is a dynamic interplay between intellectual and spiritual understandings of issues and that our system of values underlies both. For example, the Christian religion provides individuals with numerous

interpretations of the human relationship with the earth. In order to work through existing social networks like religious networks requires that individuals understand the system of values and beliefs that are at the heart of a particular network because the message or idea to be disseminated must resonate with the members of that network. As such, it is essential to work with someone who is part of the network who can identify, create, or frame the story in the most effective manner — one that is compatible with the underlying values and beliefs. The network structure is also important. If the structure is more hierarchical then successful communications will be more dependent on working with a leader or central spoke in the overall network structure. Durham's ideas also stressed the importance of understanding differences in student value systems. Students may be more highly invested in solving long-term problems since they will be more likely to be present to suffer the consequences. In addition, she emphasized the potential role of competition within social networks. Competition presents an opportunity to motivate similar groups within a larger network to outperform each other. Competition might occur between groups within a university between separate universities. For more information see McNamara (2007) and Durham (2007) under BECC Conference Presentation References.

D. Social and Cause Marketing

Social marketing seeks to achieve a particular social goal (such as reducing energy consumption) by achieving widespread, behavioral change using concepts and principles from commercial marketing. Unlike information campaigns, social marketing programs recognize that individuals face a variety of barriers associated with the adoption of a new pattern of behavior and that a lack of information may be only one of several barriers faced by people. Moreover, even when people are aware and informed as to the consequences of their actions, that knowledge is often insufficient for changing behaviors. Instead, people need to be given the proper motivation for behaving in more environmentally sustainable ways. As such, many proponents of social marketing argue that it is less about providing information and more about changing values, providing motivation, and persuading people why they should act in a particular way — all while reducing the barriers to taking action.

One way to think about the applicability of social marketing as a means of creating behavioral change is to situate social marketing work within Rothschild's Behavioral Management Continuum. As outlined by Ed Maibach (George Mason University), the continuum ranges from using education and communication initiatives on one end, to using policy advocacy and force of law on the other end. Marketing falls between the two end points. According to this framework, education/communications activities attempt to change the information environment in order to inform people or groups about the options that they currently have, while policy advocacy initiatives attempt to change the legal or regulatory environment in order to mandate, prohibit or provide incentives and/or disincentives for particular behaviors. On the other hand, marketing efforts seek to change the marketing environment in order to provide people and organizations with new options that are intended to be more attractive to them. Each of these approaches may be appropriate in a specific setting. For example, education initiatives are most appropriate when the audience is inclined to behave the way we want them to, when competing activities are weak and when the behavior is relatively easy to adopt. Policy initiatives are most appropriate when the audience is resistant to behave as we would like, when people don't see their self-interest in the behavior, and when the competition is unbeatable. Finally, marketing initiatives are well suited to initiatives when the audience is neither inclined nor resistant, when self-interest can be conveyed, when the competition is active but beatable, and when the behavior is hard to adopt without help.

One of the principal tenets underlying the social marketing approach is that people consume products and services for three primary reasons: because the products make life easier; they make life fun; or they make us popular. Social marketing seeks to make the desired behavior easy, fun and popular by

cutting through the complexity of the problem. It starts by determining a goal, then works to find the highest-leverage approach, discover the ideal technology for that approach, and make the smartest application of the technologies that are available.

A slightly different approach to social marketing discussed by Chris Nichols seeks to create voluntary behavioral change by (1) improving incentives, (2) reducing barriers, and (3) persuading people to take action (addressing motivation). Nichols advocates an approach that begins by addressing any possible structural changes that can be made toward instituting good energy use patterns as the default action. Following structural changes, the goal is to identify and target those actions that are likely to have the greatest impact with the least resource input. Nichols' approach also focuses on making the desired activities easy, fun and popular by reducing barriers to action, making the behavior consistent with social norms, and ensuring that people will find the behavior rewarding. An important emphasis is placed on the role of social networks in this process. Chris advocates building on individual and organizational social networks by expanding both horizontal and vertical linkages in existing networks. Horizontal networks include other individuals and organizations with similar objectives, while vertical networks include individuals and organizations with different but compatible purposes. Ultimately, people need to feel confident, and empowered and make a commitment to behavioral change. For more information see Nichols (2007) under BECC Conference Presentation References.

The U.S. Environmental Protection Agency and Department of Energy use social marketing strategies to promote the purchase of ENERGY STAR products. According to Maria Tikoff Vargas, their goal is not simply to provide information but to drive consumers to become "loyal" to energy efficiency. This approach evolved from an understanding that the problem wasn't simply ignorance on the part of consumers but a need to change the ratio of barriers to benefits. The Energy Star campaign uses three types of marketing: brand outreach, product marketing, and social marketing. Social marketing efforts include the "Change a light" campaign that uses public commitment, competition, social norms, persuasive communications and grass roots organizing to engage the public and encourage them to change their behavior. So far, the Change a Light campaign has succeeded in getting more than one million individuals to pledge to change 2.6 million lights. One of the core ideas is to use lighting as a gateway product to get people committed to using energy efficient appliances.

Other cause marketing approaches are more focused on mass media outlets such as television, radio and newspapers. In these cases, doing background research is key for understanding your audience and what they think. The program needs to delineate (1) who is being targeted and what we need to know about them, (2) what competing messages are also in the media, (3) the principal idea to be communicated, (4) supporting points, (5) the desired action that the campaign seeks to prompt, and (6) the tone and style that should be used to communicate the message. For more information see Tikoff Vargas (2007) under BECC Conference Presentation References.

Richard Earle used this framework as a means of exploring an approach to clean energy market building. What they found was that while consumers were willing to switch to clean energy, the effort was challenged by a lack of common language and/or terminology (do we call it green? clean? renewable? alternative?) and the fact that energy is often an invisible product. Qualitative research of consumers, businesses, and leaders attempted to reveal the most powerful emotional hooks that could make clean energy important and desirable to the American public. The research found that it was scary for people to imagine our world without fossil fuels. Clean energy was seen as a possible successor but people felt that it still had kinks to be worked out — that it wasn't yet ready. Further research revealed that images and facts that made clean energy seem powerful, real and "closer than you think" triggered very positive reactions. The campaign was built around two notions: clean energy is more real and more powerful than you think, and it can make us self-sufficient in our energy needs. For more information see Earle (2007) under BECC Conference Presentation References,

"Fostering Sustainable Behavior" (McKenzie-Mohr and Smith 2007), and "The Art of Cause Marketing" (Earle 2000).

E. New Tools

Carbon labels. Energy and carbon labels represent both old and new tools in efforts to empower consumers to use information about the economic and environmental impact of their decisions to shape their own purchasing behaviors. While energy labels are used in 73 countries to indicate the energy use associated with particular appliances, the effort to use carbon labels is just emerging. The relatively recent interest in carbon labels is focused on measuring the carbon dioxide emissions associated with the manufacture and distribution of a wide variety of products (not simply those products that require energy to operate) and the embodied energy that they represent.

Currently, energy labels are used in numerous countries primarily to indicate the amount of energy used by kitchen appliances. Some important variables that determine the effectiveness of energy labels include (1) whether the labeling programs are mandatory or voluntary, (2) whether the purpose of energy labels is to indicate the amount of energy consumed by an appliance (i.e., the Energy Guide label) or to serve as an endorsement of the energy efficiency of the appliance (i.e., the ENERGY STAR label), (3) whether or not the label's rating system is categorical or continuous, (4) who the audience is, (5) whether the label is well designed, and (6) whether the label is accompanied by a broader policy/program strategy.

Studies that have looked at the effectiveness of the labels have mostly been concerned with the effectiveness of the label itself. For example, are the labels likeable, easy to use, and/or visually appealing?

The effectiveness of energy labels varies significantly. Research performed by ACEEE and others has shown that categorical labels, like those used in much of Europe, tend to be more effective than the continuous rating labels used by the Energy Guide in the U.S.. Similarly, mandatory labeling programs tend to increase use by consumers as does good label design and its use in combination with other marketing strategies.

Although the Energy Guide label is mandatory in the U.S., research has shown that few Americans use it in their decision making because the label uses a continuous scale (rather than categorical scale) of measurement, because the label is poorly designed, and because the label has been used much more as an information tool as opposed to a means to influence market transformation. Finally research on U.S. consumers indicates that they incorrectly assume that any product that is on the market must be energy efficient. The following table compares energy labeling in the U.S., Australia and Europe.

Country	United States	Australia	Europe
Label Usage	Mandatory	Mandatory	Mandatory
Purpose	Information	Information	Information
Rating Scale	Continuous	Categorical	Categorical
Other	Limited impact on manufacturers	Newly integrated with endorsement label	
Effectiveness	Low reported use by consumers	More than 85% of consumers report using the label in purchasing decisions	10% improvement in sales-weighted efficiency of refrigerators '94-'99

The lessons that have been learned from energy labels can be useful in designing effective carbon labels as well. The following conclusions can be drawn from energy label research:

- There is no one-size fits all design.
- Consumer research is a must to understand design flaws and usefulness.
- Government endorsement is an important source of credibility.
- Labels need to be accompanied by information and education
- Integration of multiple labels is most effective.
- Must be part of a broader policy/program strategy (including labels, standards, and market transformation).

For more information see Amann (2007) under BECC Conference Presentation References.

Internet-based social networks. Social networking sites on the internet have drawn much attention recently as possible mechanisms for the diffusion of new ideas, technologies and practices. As discussed earlier, existing sites are being accessed and new sites are being formed as a means of generating and sustaining interest in climate change issues, developing nationwide political activism on behalf of the environment, engaging people and companies in social marketing campaigns through commitment, competition, and coordination, and providing tools for individuals who want to learn more about what they can do to reduce their carbon footprint and track their progress.

Smart meters and feedback systems. Anyone who looks at the aggregate statistics from the Energy Information Administration knows that energy consumption in the United States is over 100 quadrillion Btus per year and has been on an upward trend since the 1980s. However, while energy consumption patterns are a matter of concern at the aggregate level, they aren't always a topic of attention at the household and/or organizational level. Part of the problem stems from the fact that energy use and energy efficiency are largely invisible to those using it. At the household level we've gone from chopping wood, to shoveling coal, to purchasing fuel oil, to the almost effortless use of natural gas and electric furnaces.

In the process of this transition, our active involvement in the process of heating our homes and our visual appreciation of the volume of our fuel consumption have been reduced to the point that energy consumption has largely become invisible. The only thing that we're left with is the monthly utility bill. And to the degree that we can have that automatically debited from our bank account — we don't even have that as a resource.

Of course, at the same time, there has been tremendous growth in the energy services on which we rely, including what we use for air conditioning, heating, cooking, lighting, computing, television, and the whole assortment of new electronic gadgets that we all rely on. So the paradox that we're left with is that: energy is both more integral to our lives and our lifestyles, while it is also less and less visible.

While this is not a new problem, rising energy prices and concerns about global climate change have led researchers working in the field to revisit potential mechanisms for providing individuals, households and businesses with feedback about their energy consumption patterns. Sensors, computers, and other high-tech devices are now being used to provide consumers with near-real time information about their household energy consumption practices. Having access to this information allows consumers to make conscious, timely decisions about when and how much energy to consume. A variety of research projects on feedback mechanisms are currently underway, including work being done by BC Hydro and Sierra Pacific Resources to test the performance of these devices as well as their effectiveness in saving energy (as reported by Ed Vine, Research Coordinator, CIEE.)
Perhaps one of the largest initiatives, Portland General Electric Company recently announced that it would install 850,000 smart meters over the next two years. PGE is hoping to use the technology to

communicate electricity price information with consumers, allow consumers to check their energy usage on the Internet, and motivate behavioral change, reduced energy consumption, and a decline in energy costs. For more information see Wright (2007) under BECC Conference Presentation References.

Some individuals are also receiving feedback regarding the energy use patterns of their cars. Tom Turrentine, Research Anthropologist and Director, Plug-In Hybrid Electric Vehicle Center, UC Davis, has been investigating technological means of getting drivers to pay more attention to fuel economy. His research suggests that people choose fuel-efficient cars for a variety of reasons but that they don't normally sit down and calculate payback periods. Instead, they are more likely to consider good fuel economy as a value. His research also shows that Prius owners generally watch their vehicle instruments closely and alter their driving patterns to assess the impact on their fuel economy. So people are paying attention when they receive easy-to-use information. However, even the Prius instruments don't provide cumulative measures of fuel use or costs over time. Instead, people end up paying attention to others to get information about fuel economy. They listen to news programs, friends, family members, their mechanic, and the government ratings. Turrentine's research led him to conclude that instrumentation is essential to the change process. People aren't buying these cars based on calculations but because of their personal values and the symbolism of the Prius as a car of the future. According to Turrentine, hybrid cars themselves may have initiated a shift in consumer values that are not simply incremental. For more information see Turrentine (2007) under BECC Conference Presentation References.

Ideas regarding other innovative and experimental program. Several sessions advocated additional research to explore new and innovative ways to shift behavior. In his presentation, Ed Vine argued that programs need to be less risk adverse and more willing to "think outside the box". Some particular areas that deserve additional attention include options such as innovation inducement prizes, new branding and rating systems, community-wide programs, shareholder incentives, home energy rating systems, and the NE-ISO forward capacity market. For more information see Vine (2007) under BECC Conference Presentation References.

Similarly, the session on accelerating technology solutions discussed the need for programs that promoted the design and diffusion of human-centered technology innovations. This approach emphasized the need to recognize that designers and engineers of new technologies need to recognize and incorporate the complexities of human life and human decision-making and produce technologies that meet both explicit and latent needs. The basic premise is that we need to understand why and how technologies are used by real people in their everyday lives in order to design better technologies that will be used in ways that accomplish our energy objectives.

VII. RESEARCH PATHS

Among the many important outcomes of the conference was the realization that while there has been a notable re-emergence of interest and work on behavior and energy issues, there are still significant gaps in our knowledge and additional research is clearly needed to update and expand on the knowledge gained from research performed during the 1970s and 80s. This section will outline nine distinct areas of research that emerged from the conference presentations, evaluations, and discussions as topics in need of additional exploration. These areas range from research on lifestyles, social diversity and energy use to the importance of behavior in energy consumption and decision-making in business and industry.

A. Energy Efficiency Data Center

Research on behavior, energy and climate change would benefit greatly from a national, energy efficiency data center that would make data more broadly available to researchers, policy makers and others via a centralized repository of reliable data and research. Such a collection would significantly facilitate efforts to understand the drivers of individual and group behavior with regard to energy consumption and efficiency.

Unfortunately, most current data collection efforts are disjointed and data are disbursed across a wide range of utilities, nonprofit organizations, government run labs and other organizations. Moreover, much of the data that has been collected is limited in scope and often out-of-date. Currently, a large portion of the data that are available have been collected at the program level and focus on evaluating the success of programs as opposed to assessing the broader influences that drive energy consumption and energy conservation or efficiency behavior. Most of the data collected through program management efforts offer little insight into consumer and producer motivations and behaviors. Instead, research in this area would benefit greatly from studies regarding basic energy consumption behaviors to reveal the causal relationships that result in desirable and undesirable behaviors. More research needs to focus on investigating how and why people adopt particular energy consumption and/or efficiency behaviors and explain the variation that exists between individuals and groups. This type of research is particularly valuable to policy modeling efforts that seek to understand and model the likely impact of various public policies on future energy consumption. Currently, these modeling efforts can best be described as very crude reflections of current patterns of consumption, but they fail to capture important variations in the way that different groups respond to changes in energy prices and income as well as the variations in these response patterns over time.

A national, energy efficiency data center would allow for easy access to important sources of data and the ability to easily identify gaps in our knowledge and define an informed research agenda. It would also allow for the timely identification and investigation of critical research topics. Finally, a national, energy efficiency data center would reduce the cost of data collection and research as it would reduce the unnecessary duplication of effort that results from distinct and uncoordinated research programs.

B. Lifestyle and Social Diversity

Most efforts to understand patterns of energy consumption and/or the human dimensions of climate change tend to over-simplify the variation that exists across different segments of the population and instead focus on averages and other measures of central tendency. These types of approaches often fail to recognize the diversity of attitudes, opinions, and behaviors and how these differences matter in the development and implementation of successful programs, projects and policies. As such, greater research is needed to identify the variables that are the most influential in shaping the attitudes and behaviors of householders, workers, managers, politicians and others and to identify the distinct groups and patterns of variation for each of the variables in question.

Segmentation research is one means of learning more about the variation that exists between individuals and groups. This type of research can achieve a variety of objectives, including the development of effective political campaigns to enact needed legislation, as well as social marketing efforts geared toward influencing public opinion and changing behaviors. While market segmentation is often the focus of research efforts in the private sector and associated with the sales of energy-efficient appliances and products, it also has other applications. Utility programs, government programs, non-profit organizations and others could benefit from a better understanding of their audience/clientele and a refinement of their messages to meet the unique characteristics of the group(s) in question.

The need for segmentation research was illustrated in a number of BECC presentations, including the work of Mark DiCamillo (Field Research Corporation), Bill Guns (SRI Consulting Business Intelligence), and Cathy Zoi (Alliance for Climate Protection). Mark DiCamillo's recent research (commissioned by Next 10) measured the attitudes, beliefs, and behaviors of Californians. Among his findings, he found that "Californians attach a high degree of importance to the issue of global warming and air pollution and believe actions should be taken now to address the state's overall quality of life." Respondents indicated that four groups are most able to affect change: corporations, utilities, the general public, and the U.S. government. FRC also considered the results by state region and compared the opinions of registered voters to non-registered voters as well as across various socio-demographic groups (by ethnicity, level of education, income and age). Their findings indicate that registered voters and people living in San Francisco and San Diego were more likely to name global warming as the biggest environmental problem facing the world. White, non-Hispanic individuals were more likely to have heard or read about global warming as were those individuals who were more highly educated. Finally, Californians with lower household income levels tended to be more concerned about global warming, and younger individuals were more likely to perceive global warming as a serious threat to California's overall quality of life. For more information see DiCamillo (2007) under BECC Conference Presentation References.

Bill Guns' presentation focused specifically on means of leveraging segmentation to accelerate climate action. The SRI approach uses a psycho-social framework for understanding the attitudes and behaviors of individuals that moves well beyond a consideration of standard demographic variables. According to the approach developed by SRI, age, demographics and income don't provide a lot of information about environmental technology adoption. Instead SRI uses the "VALS" system which focuses on two primary concepts: What is the individual's motivation? And what emotional and psychological resources does this individual have to express their motivation? The VALS framework segments Americans into one of eight categories:

Innovators: Very innovative and a lot of resources.
Thinkers: Motivated by ideals, reflective, average resources.
Achievers: Motivated by achievement, reward oriented, career/family focused, average resources.
Experiencers: Motivated by self-expression, spontaneous, risk-seeking, different, average resources.
Believers: Motivated by ideals, traditional values, average resources.
Strivers: Motivated by achievement, approval seeking, low self-confidence, trendy, average resources.
Makers: Motivated by self-expression, home grown, self-sufficient, traditional context, average resources
Survivors: elderly, passive, risk-averse, resource constrained.

These segments are motivated by different things and will respond to different types of marketing efforts. In terms of climate change, the SRI approach focuses on four questions: (1) who cares to learn? (2) Who is listening? (3) Who is understanding? (4) Who will take action?

Interestingly, the SRI approach indicates that most fund donators come from one of two groups: innovators or thinkers. They argue that the same type of approach is important in determining the message, the media, and the incentives that should be used to shape both attitudes and behaviors. For more information see Guns (2007) under BECC Conference Presentation References.

Finally, the Alliance for Climate Protection is using segmentation in their own way to target messages to specific groups. The principal goal of the Alliance is to change public opinion with regard to climate change by developing deep public support via a campaign that addresses both facts and feelings, providing information through experts and friends, and taking advantage of both sounds and

sights as a means of getting the message across. The Alliance recognizes four types of individuals when it comes to climate change: the activists (about 9% of the population), the people who are engaged (35% of the population), the people who are afraid and/or confused by the issues (38% of the population), and the people who are ignorant or in denial (18% of the population). An important part of the Alliance's strategy is to use the activists to mobilize the large swath of the population who find themselves in the middle two groups. The strategy uses the activists to mobilize the middle two groups by giving people who are engaged an easy way to influence policy, by countering the naysayers who encourage passivity, and by empowering those who are afraid or overwhelmed by the issue. For more information see Zoi (2007) under BECC Conference Presentation References.

C. Social Context and Social Rationality

A recurring theme throughout the BECC Conference was the need to move beyond the standard economic framework generally used to understand and explain human behavior and the choices that shape energy consumption, energy conservation, and investment. Currently, the predominant approach frames behavioral change almost exclusively as a matter of individual choice, and explains energy consumption using a rational economic actor model. As witnessed by BECC Conference participants however, there is growing evidence that suggests that people frequently fail to act in accordance with economic self-interests alone. In fact, people often find it difficult to do so. For example, in both the residential and commercial sectors, it has been shown that products, homes, and buildings built to perform to a set level of energy efficiency often fall short due to operator behavior. Today, only 40% of commercial buildings are delivering the energy performance for which they were designed — a number attributed to occupant behavior. An alternative approach, used by some more recent studies, suggests that individual and organizational behaviors are also shaped in important ways by the *social* context within which people operate. In many instances, individuals are more likely to behave in *socially* rational ways, determining what is and isn't "appropriate" behavior by gleaning information from their own observations and interactions within their sphere of social influence (Ehrhardt-Martinez 2008; Ehrhardt-Martinez et al. 2008).

While a variety of projects and presentations at BECC were based on the recognition of alternative models of human behavior, further research is clearly needed in this area to improve our understanding of the ways in which social rules, resources and context are likely to shape household, commercial and industrial patterns of energy consumption. Currently, a variety of social marketing initiatives are among the projects that are working with alternative models of human behavior. (Also see the work being done by Positive Energy and Robert Cialdini.) However, additional research needs to be done to study and capture the lessens learned from these and other initiatives so that they may inform the broader portfolio of climate change and energy programs and projects and help to move them beyond the outdated paradigm that technology and economics alone will be sufficient to meet the increasingly stringent greenhouse gas reduction goals. More research is also needed to identify other key social drivers that shape our energy use patterns and to suggest new frameworks for understanding energy consumption and designing program approaches that integrate this understanding.

D. Embodied Energy and Consumption Choices

In the modern world, nearly all human behaviors hold energy implications. Nevertheless, sometimes the link between action and implication is direct and sometimes it is indirect. When we drive to work or fly to our favorite vacation destination, the energy implications associated with our travel choices and our actions are direct and easily measured. Similarly, when we set the thermostat in our house, there is a direct effect between our heating and cooling decisions and the amount of energy we consume. But what about the food we choose to eat? The clothes we choose to wear? The house we

choose to live in? Or the type of leisure activities that we choose to participate in? While the energy implications of these choices may not be equally apparent, they may comprise a larger proportion of our energy footprint than the direct effects that we tend to be more conscious of.

In an assessment of social and behavioral science research priorities associated with decision making and the environment, the National Research Council explicitly recognizes the need to carefully account for the energy implications of consumer choices (NRC 2005). According to the report, "studies of materials and energy flows that combine physical science expertise and an understanding of human behavior patterns can provide useful information about the relative impacts of common behaviors and choices, as well as significant alternatives…"(NRC 2005: 73), Such choices include the eating of different foods, eating at home versus in restaurants, using different sorts of appliances, buying durable versus disposable consumer products, etc.

Being able to determine the environmental significance of consumption is an important first step in allowing people to make informed choices as well as actively manage their environmental impact. Some initial research efforts have focused on "food miles" and "carbon labeling". The effort to document "food miles," or the distance that food travels before it is consumed, was initiated by Tim Lang who was looking for a means of revealing the hidden ecological consequences of food production to consumers in a simple manner. However, while this measure of the environmental impact of food choices may be effective in assessing the energy implications associated with a local versus global food system, it is primarily focused on the environmental consequences associated with transportation and largely ignores the other ways in which food consumption choices contribute to climate change and environmental degradation. A more holistic approach seeks to understand the climate implications of food and other products by broadening the assessment to include measures of how the products were produced and the amount of energy used in their production. This type of information can then be communicated to consumers through the use of a carbon labeling scheme. In order to be successful, however, research on embedded energy and life cycle assessments must be made "behaviorally relevant" by linking them to important consumer choices (NRC 2005: 71).

While efforts continue to develop accurate accounts of the materials and energy flows, additional consideration should be given to the development of simple heuristics that consumers can use to assess the climate implications of their consumption choices.

E. Symbolism, Identity and Rebound

A broad assortment of factors influences consumer choices and human behavior. Researchers and energy-efficiency practitioners need to be more cognizant of those factors that are most influential in shaping the handful of human behaviors and choices that have the largest climate impact — particularly choices regarding residence, transportation, and social norms regarding the scale of consumption. Further research is also required in order to understand how some efficiency gains are eventually lost through rebounds in consumption or increased demand for energy services.

There is already evidence to suggest that social status and identity are important in shaping car buying decisions (Turrentine and Kurani 2007; Heffner et al. 2006). However additional research needs to be done to develop a deeper understanding of these relationships and how they can inform programs and policies aimed at reducing energy use and carbon emissions. Similarly, additional research needs to consider how social status, identity, and other factors shape our house buying decisions, whether in terms of location, size or other features. Finally, additional research should explore how clothing choices are shaped by issues of identity and status and how these choices affect heating and cooling requirements.

Resource consumption is both a function of economic well-being and a means of communicating something about ourselves as individuals. As such, research on the energy implications of consumption need to consider more than the economics of what we can afford to purchase; it also must consider our drive to consume more than we can afford and our choices among products and services. Semiotics, the study of signs and symbols as elements of communicative behavior, represents an important approach to understanding our consumptive behavior and its implications for energy and climate change.

F. Energy: Visibility and Ubiquity

Over the course of the past 50-60 years, our reliance on energy and energy services has grown tremendously. At the same time, we have become increasingly disconnected from the energy resources that fuel our consumption patterns. As a result, the amount of energy that we consume has increased dramatically, while it has also become increasingly difficult to discern and therefore to manage. From the perspective of most people, our electricity needs are met through the plug in the wall. Heating and cooling are a function of setting the thermostat to the desired temperature. Our only direct contact with our energy resources is pumping gas into our cars. How can we actively and consciously manage our resources when they are largely invisible to us?

Numerous past studies on the topic have found evidence to suggest that energy use could be reduced by providing energy consumers with information and feedback regarding their household energy use. Some recent efforts are currently exploring the use of smart meters and other high tech devices for providing consumers with even greater levels of detail regarding their energy consumption patterns. Many of these studies have also encountered positive results. Nevertheless, more research needs to be done to explore how issues of energy visibility/invisibility and the ubiquity of energy consuming products affect energy consumption patterns. To what degree is our energy use simply a function of the growing number of energy using gadgets and gismos that populate our homes, offices, and cars? To what degree is it a function of the invisibility of our energy delivery systems? How might the pursuit of a predominantly technological fix to our energy problems exacerbate our unconscious and growing demand for energy?

G. Trade Allies, Choice Points and Choice Architecture

Efforts to distill the core lessons from multiple lifetimes of experience in energy program and policy research suggest that more research needs to be performed to tease out the potential energy savings that could be gained via targeted efforts to work with trade allies and via programs that focus on choice points associated with consumer purchasing decisions. In her recent white paper publication on lessons learned from 30 years of program evaluation, Jane Peters (2007) notes “trade allies are key to program success.”

Trade allies include electricians, plumbers, contractors, and people who work in the building trades to build and maintain residential, commercial, and industrial buildings. They are often trusted sources of advice in the consumer decision making process and they frequently advise consumers and influence their decisions when deciding which products and/or models to purchase. Despite their somewhat privileged position, however, not all trade allies take a pro-efficiency stance. At the end of the day, trade allies are business people and a lack of training or poorly structured efficiency programs can reduce the likelihood that they will promote energy efficient products and processes. Peters’ paper recognizes the need to work closely with trade allies by providing them with the ongoing training that they need and by designing programs and incentives that effectively take into account the unique challenges that trade allies face.

A related and equally important concept is that of consumer choice points. Paul Stern's research highlights the importance of providing information at critical junctures such as those specific points in time when consumers are faced with real choices regarding which product(s) or service(s) to buy. Stern's research emphasizes providing the right type of information, in the most effective format, and at the time at which decision making occurs. When combined with multi-pronged programs designed to reduce barriers, choice point oriented information is likely to have the biggest impact on the purchase of energy-efficient products.

Since trade allies are often present and influential in shaping many consumer choices, there may be an added synergy associated with programs targeting choice points via programs that work closely with trade allies. According to Peters (2007) "a key point for reaching consumers and businesses is at the time they are making a purchase or choosing to remodel their home or building. If the program is not working with trade allies, then those natural market-decision points are missed."

Additional research should focus on identifying successful strategies for combining choice-point focused information programs with efforts to work more closely with trade allies and measuring the impact that these programs might have both via the delivery of new technologies as well as through the provision of information regarding technology use and maintenance.

H. Behavior in Business and Industry

Research efforts that seek to understand energy-related behaviors often overlook the role that behavior plays outside the residential sector in business and industry. As such, much more research is needed to identify and understand how the energy-related decisions and behaviors of business leaders, managers, and workers are shaped and constrained. What are the common and distinct barriers and opportunities to smart energy actions encountered throughout the business community?

The BECC session on Business and Industry served to provide some preliminary insights regarding research topics in need of future investigation. For example, the session included several presenters from the business community who recognized that while businesses clearly behave differently than individuals and households and tend to be more concerned about profits and the bottom line, they don't always act in ways that might be considered rational.

Also at the core of the discussion was the need to recognize the diversity of interests and motivators within the business and industrial communities while also looking for patterns and trends for specific variables of interest. For example, presenters suggested that privately-held and publicly-held companies are likely to face distinct sets of concerns that result in different sets of behaviors and energy-related strategies. Other factors that were recognized as important included whether or not companies rely on a strong public brand; whether or not sales and production are local, regional, national, or global; and whether energy conserving behaviors are voluntary or compulsory. For example, companies that rely on a strong public brand and that rely on local markets are more likely to be conscious of and responsive to public concerns.

Of course, the impact that companies on the environment is broader than the impacts of manufacturing. The energy implications of a particular company's operations extend across a variety of areas, including: (1) the energy demand of their manufacturing and service processes; (2) the energy demand of the products that they produce (e.g., TVs, computers, cars, etc); (3) the energy demand of their transportation networks; (4) the energy demand of their supply chain; (5) the energy demand of their work force; and (6) their influence on consumers' purchasing decisions and behaviors.

Business culture and organizational structure are also likely to shape energy-related decision-making and behavior in important ways. Organizational, or even industry-wide norms, values, practices, and ideologies determine how likely an organization is to address environmental and energy-related concerns, as well as who is likely to be involved and the methods by which those concerns are addressed and how effective they might be. According to Joel Levine (CA Climate Action Registry), one key to success is identifying and working with a senior level employee within the organization who willing, interested and able to champion the issue. Big businesses are concerned with regulatory compliance and the bottom line. They want to know costs and benefits. However the decisions are not made in a vacuum; companies must evaluate their use of energy and investments in efficiency within the context of many competing issues and decisions. As such, efficiency is only one of several factors that are taken into consideration when businesses make decisions about how to invest their time and money. (See Levin 2007, Waldelich 2007, Rodrigues 2007 under BECC Conference Presentation References.)

Although data and research findings on this topic are minimal, the National Research Council has recognized a need to increase research on corporate environmentalism and environmental decision making. In a recent publication entitled "Decision Making for the Environment" (NRC 2005), Hoffman (2005) specifically discusses research on corporate environmentalism. In his discussion of organizational behavior, Hoffman points out, "environmental concerns are becoming infused into the relationships among firms and trade associations, insurance companies, shareholders, investment funds, financial institutions, environmental non-governmental organizations, the local community, individual citizens, the press, consultants, and employees." (p. 215)

Similarly, Brewer and Stern identify seven specific areas in need of further research:

1. Environmental performance and competitive advantage
2. Customer and investor demand
3. Supply chains and production networks
4. Sectoral standard setting
5. Decision Factors in industrial ecology
6. Environmental accounting and disclosure practices
7. Government policy influences on business decision making

As stated by Brewer and Stern, research on these topics "could produce not only advances in scholarly understanding but also practical improvements in the environmental performance and in the efficiency and competitiveness of businesses." (p. 67). Feedback from the BECC Conference reinforces the need for behavioral research on energy-related issues within the business community. Moreover, companies themselves are recognizing the importance of environmental governance and performance to the success of their organizations. "More than 40% of these firms believed that effective environmental governance added value to their operational efficiency as well as their corporate image, and 28% reported increased value to their competitive position." (p. 67)

I. Accelerating Innovative Behavior and Technological Solutions

Technological solutions to energy problems rely on behavior change. Both, innovation and the diffusion and adoption of new technologies comprise important behavioral components of technological solutions to energy problems. While much attention has been given to both innovation and diffusion in general, more research is needed to understand how these processes are affected by culture and value systems. In other words, understanding the technical nature of the problem being considered is just the first step in developing solutions. However, solving energy problems also requires an understanding of how people interpret the problem and the available solutions.

Historically, most diffusion models have taken an economic approach to assessing the rate of technology adoption. However, more recent research suggests that values and design are also important. For example, according to research on hybrid electric vehicles (Turrentine and Kurani 2007), car companies initially anticipated that buyers held certain economic expectations that would need to be met before they would invest in hybrid technologies. According to economic research performed by car manufacturers, buyers wanted to be able to recover the added expense of new fuel economy technologies through reduced energy costs in a period of three years or less. However, Turrentine's research indicates that hybrid buyers are not so calculating. They approached the investment differently. Instead of payback concerns, hybrid buyers were more likely to consider good fuel economy because it was consistent with their larger system of values. In other words, good fuel economy was part of a value system and not merely an economic calculation. For hybrid owners, purchasing a hybrid was more about expressing their values to others than it was about achieving a return on an investment. Ultimately, while price is important, it is equally important to understand the knowledge, values and motivations held by would-be users of the technology.

Behavior is also important on the innovation end of generating much-needed tools to reduce our energy consumption. In this case, research is needed to examine ways of encouraging the development, production, and deployment of innovative technologies and services. This research should focus on generating greater insights into the mechanisms that catalyze innovative behavior and that result in new technologies and services, increased energy efficiency, and reduced energy consumption.

VIII. EMERGING RESEARCH CONCERNS

While the research paths discussed above, represent topics that were addressed through one or more topic sessions at the BECC Conference, a variety of other research interests were also identified. This section briefly introduces six emerging areas of research.

A. Scale and Geography of Production, Appropriate Technology, and Appropriate Production

Eating locally produced food has recently gained a lot of attention as a means of addressing climate change in a way that is within the control of individual consumers. Local production saves energy primarily through a reduced need for long-distance transportation. However this approach could be expanded to consider the energy implications of local production of nonfood items as well. Importantly, concern over the geography of production is a potential countervailing trend to the globalization of production, and more research is needed to assess the energy implications associated with the location of production and consumption. An associated question is concerned with the scale of production and its relationship to the types of technologies employed and the amount of energy used. This line of research needs to ask: How does the organization of production shape the energy and climate change implications of the products and services on which we rely? Is smaller or larger scale technology more appropriate for local systems of production and are those technologies more or less energy intensive?

B. Personal Carbon Budgets, Consumption Limits, and Energy Efficiency

An alternative means of reducing the nation's carbon footprint is to shift the focus of national policy from production-based carbon footprints to consumption-based carbon budgets or allowances. Instead of setting industrial and commercial carbon caps, policymakers could set personal carbon consumption limits. Consumers would then have the freedom to choose their purchases but total purchases would be constrained by maximum monthly (or annual) carbon limits. As a result, producers would not only compete for market share as a function of price and quality but would also

compete against other producers for the lowest carbon product. Such an approach would focus on consumer behavior directly and producer behavior indirectly. Moreover this approach could limit the effect of population growth

Per capita carbon budgets would be determined by a country's total CO2 absorption capacity such that population growth would require a downward adjustment in per capita carbon budgets. Firms could increase output only if they were able to reduce the carbon emissions per unit of output, inducing efficiency gains and eliminating the possibility of rebound through consumption behavior.

C. Social Structure, Agency, and Empowerment

How do existing social structures in the energy production industries, the energy efficiency industry and energy distribution industries shape and constrain the ability of individuals and groups to identify, develop, and employ alternative means and systems for meeting their energy service demands? What are some of the ways in which individuals and groups are taking action to change or challenge existing social structures? What means might be employed to further engage and empower energy consumers and local communities?

D. Inequality, Poverty, Affluence, Wants, and Needs

Over the course of the past 30 years, the United States and the world have experienced an increased polarization of income and wealth. Research on inequality and environmental degradation suggests that the largest environmental impacts are caused by the wealthiest and the poorest segments of a population (particularly within societies with significant levels of inequality). The wealthy tend to consume products and services in large quantities, frequently travel long distances, and are largely insensitive to price fluctuations in energy prices. The poor tend to have few choices in their lifestyles and consumption choices. While they are generally only responsible for minimal absolute levels of consumption, their consumption of energy is often inefficient and contributes disproportionately to carbon emissions. Often the poorest segments of the population consume the cheapest and dirtiest sources of energy such as dung, wood, and coal. Moreover, inequality itself may contribute to competitive consumption as people continually assess their level of wealth and well-being relative to those around them. As a society, increased wealth tends to move people from needs-based consumption to wants-based consumption. Given that there are no limits to wants, higher levels of inequality in wealthy societies are likely to result in higher levels of consumption.

E. Demographics, Population Growth, and Age Structure, Households

Studies on the relationship between population growth, population density, and environmental degradation are well established. Not surprisingly, all else equal, larger and more urban populations tend to consume more energy resources. What is less clear is how changing demographic patterns also shape energy consumption patterns. For example, how might different population age structures shape energy use patterns? Do older people who generally like warmer environments increase energy demand? Or are the energy-dependent lifestyles of younger populations more energy intensive? Similarly, how do changing household structures affect energy use patterns? Do smaller households reduce or increase overall levels of energy consumption? And how closely is urban sprawl associated with energy consumption or is the distance to work/school and access to public transportation more important?

F. Geography, Transience, and Mobility

Since heating and cooling comprise the largest proportion of residential energy use in the United States, energy consumption is clearly rooted in geography. Residential end-use data for 2001 indicate that household energy consumption associated with household heating is more than twice as high in

the Northeast and Midwest as it is in the Southern and Western United States. Even when air conditioning is taken into consideration, energy consumption in the Northeast and Midwest far surpasses that of the Southern and Western states. As a result, the demographic shift from the rust-belt to the sun-belt should result in favorable energy consumption patterns. On the other hand, the level of transience may also affect energy efficiency given that more transient populations may be less likely to make long-term investments in energy-efficient household technologies.

IX. SUMMARY AND CONCLUSION

Human behaviors (and the social structures that shape them) have been established as a primary cause of climate change but they must also be an essential part of the cure. The irony is that while people are increasingly reliant on energy resources, finding a solution to our energy dilemma will require that we reinvest in ourselves, because human resources are the key to reducing both our energy service demands and our energy consumption. In other words, smart behaviors, smart choices, and smart planning should be thought of as an essential resource for achieving energy and climate goals. But in order to reveal and recognize the breadth and scope of our human and social resources we need to start by simply rethinking the role of human behavior and recognizing that energy consumption is a function not only of what we do but also of what we invent, of what we buy, and of how we make it. It is a function of what we grow, of what we eat, and how we grow it. And it is a function of where we live, how we travel, and of our own expectations and values. As such we need to consider the wide ranging dimensions of human life. And we need to think about people not simply as consumers or rational actors but as social actors, political actors, and moral actors. And finally we need to understand *organizational* behavior and the ways in which social structures both shape and constrain the behaviors of individuals and organizations.

In an effort to jump start this process, the 2007 Behavior, Energy and Climate Change Conference brought together many of the people working on behavior-based approaches to energy and climate change, and it established a solid platform from which to build new policies, new programs, and new research. Some of the core elements of this new foundation are discussed below.

A. Policies

Far-reaching policies are essential for ensuring the effectiveness of efforts to change individual, household and organizational behavior. Policies can make inconvenient behaviors convenient, they can make expensive behaviors less expensive, and they can remove structural, institutional, and legal barriers to behavioral change. Not surprisingly then, the effectiveness of behavioral interventions has been found to increase when combined with various policy instruments. Interestingly, however, policy models often fail to adequately integrate the social and behavioral determinants of energy consumption and energy efficiency. The results are problematic for several reasons. Primary among these is the fact that potential, behavior-based energy savings are generally underestimated or assumed to be zero, while the behavioral opportunities often go unrecognized. Of course, unrecognized opportunities remain invisible to potential funders and unfunded programs have little impact on patterns of energy consumption

Importantly then, until existing policies adequately recognize and pursue potential behavior-based energy resources, these important resources will continue to be underestimated and much of the potential savings will be left unrealized. As such more research is needed to better document the size and scale of existing behavioral resources, measure their persistence over time, reduce the technology biases that are built into measurement and evaluation methodologies, and incorporate potential behavior-based energy savings into leading policy models. Also of utmost importance is the need for policies to recognize and accommodate the diversity that exists across the population in terms of energy use, social and cultural constraints and resources, and values, norms and ideals. Policies that

attempt to address the human dimensions of climate change and energy consumption simply using measures of central tendency (such as the average) will most likely be ineffective. Finally, policies that attempt to maximize behavior-based energy savings must recognize the importance of organizational behavior and the role of trade allies in shaping energy consumption patterns and take an active role in shaping choice architecture to help households and organizations make wise energy choices. Ultimately the goal of policy should be to enable and facilitate smart energy choices and behaviors in a way that recognizes the diverse human and social circumstances in which those choices are made.

B. Programs

Interest in behavior-oriented programs has resurged in recent years, but the programs that are evolving differ from prior attempts to change patterns of energy consumption in important ways. Of particular note, recent efforts are more innovative, more sophisticated, and more likely to effectively address the non-economic drivers of human behavior. These new programs borrow theories, ideas, and approaches from a variety of disciplines including public health, communications, sociology, anthropology, psychology, human ecology, public policy, business, and marketing among others.

Among the methods used in the field of public health are entertainment based approaches that allow people to learn new behaviors by vicariously experiencing the actions of other people through a process known as social learning. Many of these applications also employ sophisticated methodologies that require knowledge of the audience, the media, and the local resources. Similarly, efforts that use a social marketing approach often use competitions, social pressure and social norms to favorably shape the behaviors of individuals and organizations, while other approaches study heuristic devices, persuasion mechanisms, and new high-tech modes of networking as well as their potential impact on energy consumption. Finally carbon labels and feedback devices are among the new tools being employed in some of the new, behavior-based energy programs.

Future program efforts should continue to innovate and experiment by drawing on lessons learned from other disciplines. In order to do so, programs need to be less risk adverse and more willing to "think outside the box." Some specific suggestions include the use of innovation inducement prizes, new branding and rating systems, community-wide programs, shareholder incentives, and home energy rating systems. Programs should also emphasize the need for human-centered design and innovation that recognizes the complexities of human life and human decision-making and produce technologies that meet both the explicit and latent needs of the individuals using them.

C. Research

While there has been a notable re-emergence of interest in and work on behavior and energy issues, the lack of research since the mid-1980s has resulted in significant gaps in our knowledge regarding effective behavioral approaches. As such, there is no doubt that behavior-based efforts aimed at expediting our nation's transition to an energy-efficient, low-carbon economy will require a concerted and a coordinated research effort. The good news is that a behavioral approach can provide a readily available and largely untapped source of significant energy savings. However the danger lies in the potential for faulty assumptions and beliefs that understanding human behavior is a simply an exercise in understanding the obvious. Instead, the timely development of useful knowledge will require the creation of a new research mechanism that (1) allows for the speedy accumulation of knowledge, (2) minimizes the duplication of effort, (3) maximizes the use of financial and human resources, and (4) provides a means of facilitating broad access to research findings.

Unfortunately, most current data collection efforts are disjointed and data are disbursed across a wide range of utilities, nonprofit organizations, government run labs and other organizations. Moreover, much of the data that has been collected is limited in scope and often out-of-date. Currently, a large

portion of the data that are available have been collected at the program level and offer little insight into consumer and producer motivations and behaviors. Instead, research in this area would benefit greatly from studies focused on investigating how and why people adopt particular energy consumption and/or efficiency behaviors and those that explain both the trends and the variation that exists between individuals and groups. A national, energy efficiency data center could accomplish all of these objectives.

In terms of behavioral research topics, a number of areas deserve prompt attention. Of particular note is the need to reveal the important patterns and trends in energy consumption and energy conservation as they exist across specific segments of the population. Past efforts have focused on understanding "the average consumer" and are particularly problematic because they mask the dramatic levels of variation that exist between groups and/or segments of the population (see Lutzenhiser and Bender 2008). As a result, programs that target the average consumer will consistently miss their mark and be ineffective at reducing energy consumption. By studying the variation in patterns, programs will be more effective and efficient in their strategies.

New research efforts should also explore the importance of social context and social motivations and their impact on individual and organizational behavior. Contrary to prior beliefs, growing evidence suggests that people frequently fail to act in accordance with economic self-interests alone. In fact, people often find it difficult to do so. As such, it is important that new research adopts alternative models of human behavior and explores the ways in which social rules, resources and contexts influence attitudes, preferences and ultimately behaviors.

Finally, a concerted research effort needs to explore a range of other important research topics including:

1. the impact of consumption choices and the energy embodied in the products that we consume,
2. the importance of symbolism, identity and rebound in shaping energy consumption patterns and the persistence of savings,
3. the ways in which the variation in the visibility of energy and modern, urban lifestyles can shape energy consumption patterns,
4. the importance of choice points and the impact of choice architecture and trade allies on energy consumption,
5. the impact of behavior and social structure on patterns of energy consumption in businesses and industry, and
6. the best means of accelerating innovative behavior and the effectiveness of new technologies in reducing energy consumption.

These findings suggest that behavior-based programs and policies can dramatically reduce energy consumption whether in households, industries, commercial buildings or cars. However, achieving these savings will require specialized knowledge, research funding and coordination, experimentation, innovation, and imagination. Given the challenges of climate change and dwindling energy resources, now is the time to tap into the existing reserve of behavior-based energy savings.

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Perry, Noel. 2007. "Results: Next 10/Field Global Warming Survey of Californians: Perceptions of Costs and Opportunities." Topic Session 2B. *People are Different: Understanding Opinions, Attitudes and Segments.* (Thursday, November 8, 2007).

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Turrentine, Tom. 2007. "Accelerating Technological Change: Getting Consumers to Pay Attention to Fuel Economy." Topic Session 4A. *Accelerating Technology Solutions.* (Friday, November 9, 2007).

Vine, Ed. 2007. "Closing the Loop between Evaluators and Implementers: Innovation and Experimental Design." Topic Session 4B. *Leveraging Past Lessons for Current Action.* (Friday, November 9, 2007).

Waidelich, George. 2007. "Panel on Business Perspectives." Topic Session 4C. *What Motivates Businesses to Change.* (Friday, November 9, 2007).

Wilson, Charlie. 2007. "Economic and Non-Economic Approaches to Behavior: Insights for Energy Models." Topic Session 1A. *Improving Assumptions, Theories and Models.* (Thursday, November 8, 2007).

Wright, Paul. 2007. "Involving Stakeholders from Conception to Adoption: Demand Response Case Study." Topic Session 4A. *Accelerating Technology Solutions.* (Friday, November 9, 2007).

APPENDIX A: LIST OF PRESENTERS AND MODERATORS

Jennifer Thorne Amann, Senior Research Associate, ACEEE

Carrie Armel, Conference Co-Chair, Precourt Institute for Energy Efficiency

Sharyn Barata, Vice President, Opinion Dynamics Corporation

Renee Bator, Associate Professor, Psychology, State University of New York, Plattsburgh

Sylvia Bender, California Energy Commission

Carl Blumstein, Director, California Institute for Energy and Environment

Jamais Cascio, Institute for the Future, Fellow, Institute for Ethics and Emerging Technologies

Ralph Cavanagh, Senior Attorney, Natural Resources Defense Council

Robert Cialdini, Professor, Psychology, Arizona State University

Jeanne Clinton, Clean Energy Advisor, California Public Utility Commission

Rick Diamond, Senior Advisor, California Institute for Energy and Environment

Mark DiCamillo, Senior Vice President, Field Research Corporation

Crystal Durham, Executive Director, California Student Sustainability Coalition

Richard Earle, Author of "The Art of Cause Marketing"

Karen Ehrhardt-Martinez, Conference Co-Chair and Research Associate, ACEEE

James Goldstene, Executive Officer, California Air Resources Board

Dian Grueneich, Commissioner, California Public Utilities Commission

Bill Guns, President and CEO, SRI Consulting Business Intelligence

Andy Hargadon, Director, Center for Entrepreneurship, University of California, Davis

Merrilee Harrigan, Vice-President for Education, Alliance to Save Energy

Stuart Hickox, Executive Director, Project Porch Light, One Change

Marvin Horowitz, President, Demand Research

Martha Krebs, California Energy Commission

Jon Krosnick, Frederic O. Glober Professor in Humanities and Social Sciences, Stanford University

John A. "Skip" Laitner, Senior Economist for Technology Policy, ACEEE

Craig Lawrence, Practice Lead, Consumer Experience Design, IDEO

Anthony Leiserowitz, Director, Yale Project on Climate Change, Yale University

Joel Levin, Vice President, Business Development, California Climate Action Registry

Loren Lutzenhiser, Conference Co-Chair and Professor, Portland State University

Edward Maibach, Professor and Director, Center of Excellence in Climate Change Communication Research, George Mason University.

Jennifer Mankoff, Human-Computer Interaction Institute, Carnegie Mellon University

Rev. Dexter McNamara, Executive Director, Interfaith Service Bureau

Steve Nadel, Executive Director, American Council for an Energy-Efficient Economy

Chris Nichols, Senior Marketing Manager, Academy for Educational Development

Ernie Paicopolos, Principal, Opinion Dynamics Corporation

Noel Perry, President, NextTen

Jane Peters, President, Research into Action

Jackalyne Pfannenstiel, Chair and Commissioner, California Energy Commission

Valerie Richardson, Director, Consumer Energy Efficiency, Pacific Gas and Electric Co.

Gene Rodrigues, Director of Energy Efficiency, Southern California Edison

Art Rosenfeld, Commissioner, California Energy Commission

Ira Ruskin, CA Assembly member, 21st Assembly District

William Ryerson, President, Population Media Center

Beth Sachs, Executive Director, Vermont Energy Investment Corporation

Linda Schuck, BECC Conference Chair, CIEE

Steve Schiller, CIEE and California Climate Action Registry

Paul Stern, Director, Committee on the Human Dimensions of Global Change, National Research Council

Jim Sweeney, Director, Precourt Institute for Energy Efficiency, Stanford University

Ken Tiedemann, Power Smart, British Columbia Hydro

Maria Tikoff Vargas, US EPA, Brand Manager for Energy Star

Tom Turrentine, Research Anthropologist & Director, Plug-in Hybrid Electric Vehicle Center, UC Davis

Ed Vine, Research Coordinator, California Institute for Energy and Environment

George Waidelich, VP Energy Operations, Safeway Inc.

Charlie Wilson, Institute for Resources, Environment and Sustainability, University of British Columbia

Paul Wright, A. Martin Berlin Chair in Mechanical Engineering, UC Berkeley

Cathy Zoi, Founding CEO, Alliance for Climate Protection

APPENDIX B: CONFERENCE SCHEDULE

becc

November 7- 9, 2007
Radisson Hotel, Sacramento, CA

BEHAVIOR, ENERGY & CLIMATE CHANGE CONFERENCE

Schedule-at-a-Glance

WEDNESDAY	NOVEMBER 7		
6:30-8:30 PM Edgewater Ballroom	Behavior & Innovation Conference Kick-off and Networking Reception		

THURSDAY	NOVEMBER 8		
7:30 - 8:30 AM	Continental Breakfast		
8:30 - 10:30 Edgewater Ballroom	Behavior, Energy & Climate Change Opening Plenary		
10:30 - 11:00	Break		
Topic Session 1 11:00 - 12:30	Topic 1A - Edgewater #4 Improving Assumptions, Theories and Models	Topic 1B - Edgewater #3 Individual Behavior in a Social Context: Norms and Networks	Topic 1C - Edgewater #2 Information, Education and Voluntary Action
12:30 - 1:30 PM	Lunch		
Topic Session 2 1:30 - 3:00	Topic 2A - Edgewater #4 Behavior as a Reliable Resource for Energy Efficiency and Emissions Reductions	Topic 2B - Edgewater #3 People are Different: Opinions, Attitudes and Segments	Topic 2C - Edgewater #2 Building on Experience: What We Can Learn from Entertainment and Other Fields
3:00 - 3:30	Break		
Topic Session 3 3:30 - 5:00	Topic 3A - Edgewater #4 Science, Policy Design and Political Leadership	Topic 3B - Edgewater #3 Motivating Individuals to Action: Success Stories	Topic 3C - Edgewater #2 Mobilizing Action in Communities and Groups
5:15 - 5:30	Website/Database Demo (Rm #3)		
5:30 - 7:30 Edgewater Ballroom	Poster Session & Reception		
8:00 - 9:30	Participant Organized Discussions		*Check bulletin board at Reg. Desk*

FRIDAY	NOVEMBER 9		
7:30 - 8:30 AM	Continental Breakfast		
8:30 – 9:45 Edgewater Ballroom	Influencing Climate Behavior Keynote Plenary		
9:45 – 10:15	Break		
Topic Session 4 10:15 - 11:45	Topic 4A – Edgewater #4 Accelerating Technology Solutions	Topic 4B – Edgewater #2 Leveraging Past Lessons for Current Action	Topic 4C – Edgewater #2 What Motivates Businesses to Change
11:45 – 1:45	Lunch and Closing Plenary		
12:30 - 1:45 Edgewater Ballroom	Behavior and Policy: Future Directions Plenary Panel		
2:00	Conference Adjourns		
2:00 - 4:00 Edgewater #4	Planning What's Next Post-Conference Informal Session		

ACEEE ciee Precourt Institute for Energy Efficiency STANFORD UNIVERSITY

Convened by American Council for an Energy-Efficient Economy http://aceee.org, California Institute for Energy and Environment, University of California http://ciee.ucop.edu, & Precourt Institute for Energy Efficiency, Stanford University http://piee.stanford.edu

APPENDIX C: STUDENT NOTETAKERS, BECC ADVISORY COMMITTEE, AND BECC SPONSORS

Student NoteTakers:

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Vanderbilt University

Howard Chong
University of California at Berkeley

Sieren Damsgaard Ernst
Sanford University

Ezra Markowitz
University of Oregon

Leslie Martin
University of California at Berkeley

Connie Roser-Renouf
George Mason University

Carolyn Snyder
Stanford University

Alex Solis
University of California at Berkeley

Chris Warshaw
Stanford University

BECC Advisory Committee

*Carrie Armel
Conference Co-Chair
Postdoctoral Fellow, School of Medicine
Prevention Research Center
Stanford University

*Carol Baker
Chief of Staff for Speaker Nunez
California State Assembly

*Sharyn Barata
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Opinion Dynamics Corporation

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Professor, Haas School of Business
University of California, Berkeley

*Carl Blumstein
Director, CIEE

*Ralph Cavanagh
Senior Attorney
Natural Resources Defense Council

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Chief Consultant, Committee on
Energy, Utilities & Communications
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*Jean Clinton
Clean Energy Advisor
California Public Utilities Commission

*Michael Closson
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*Linda Cohen
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*Mark DiCamillo
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Paul Ehrlich
Professor and Director
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*Karen Ehrhardt-Martinez
Conference Co-Chair
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*Mark Gaines
Director of Consumer Program
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*James Goldstene
Project Manager for Greenhouse Gas Reduction
California Air Resources Board

*John Griffing
Director, Public Service Program
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President and CEO
SRI Consulting Business Intelligence

*Catherine Hackney
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*Bridgett Luther
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Flex Your Power Energy Program

*Noel Perry
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NextTen

*Jane S. Peters
President
Research Into Action, Inc.

*Jackie Pfannenstiel
Chair and Commissioner
California Energy Commission

*Wendy Reed
Campaign Manager, ENERGY STAR
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*Roland Risser
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APPENDIX D: RELATED CONFERENCES AND ORGANIZATIONS

Related conferences: The following conferences can provide the reader with further research and discussion on the topic of behavior, energy, and climate change.

Conference	Convening Organization	Timing	Frequency
Behavior, Energy and Climate Change	ACEEE, CIEE, PIEE	November	Annual
Market Transformations	ACEEE, CEE	Spring	Annual
Buildings Summer Study	ACEEE	August	Biennial
Accelerating Change for Energy Efficiency and Renewables	Summit Blue	Variable	Variable
Lifestyles of Health and Sustainability	Natural Marketing Institute	Spring	Annual

Organizations:

ACEEE: American Council for an Energy-Efficient Economy
ASE: Alliance to Save Energy
Apollo Alliance
CEE: Consortium for Energy Efficiency
CIEE: California Institute for Energy and Environment
DOE: U.S. Department of Energy
EPA: U.S. Environmental Protection Agency
LBNL: Lawrence Berkeley National Laboratory
NRC: National Research Council
NREL: National Renewable Energy Laboratory
ORNL: Oak Ridge National Laboratory
PIEE: Precourt Institute for Energy Efficiency
PNNL: Pacific Northwest National Laboratory

APPENDIX E: CPUC COMMISSIONED WHITE PAPERS

• Energy efficiency potential studies and behavior
This white paper will examine how energy behavior (a) is currently being used in the analysis of energy efficiency potentials (particularly economic) in California and elsewhere, and (b) could be used or improved in the analysis of energy efficiency potentials (particularly economic) in California. Types of energy behavior include setting thermostats on water heater, space heater, or air conditioner, placing insulated tops on swimming pools, etc.
Lead Author: Mithra Moezzi (Ghoulem Research)

• Measurement and evaluation of energy savings and non-energy impacts from energy efficiency behaviors
This white paper will examine how energy savings and non-energy impacts (e.g., comfort and convenience) from energy efficiency behaviors could be measured and evaluated. This paper will also include a discussion of the attribution of savings, takeback (rebound effect), and persistence of savings/behavior from these behaviors.
Lead Author: Lisa Skumatz (SERA)

• Process evaluation's insights on energy efficiency program implementation
This white paper will examine insights on energy efficiency program implementation, with a focus on behavioral issues, learned from reviewing thirty years of process evaluations in California and elsewhere. This paper will include a discussion of improvements in the methodology of conducting process evaluations across similar programs as well as for specific types of programs.
Lead Author: Jane Peters (Research Into Action)

• Behavioral assumptions underlying energy efficiency nonresidential programs
This white paper will examine the assumptions underlying the design and implementation of energy efficiency programs and the basis and validity of these assumptions in the non-residential sector. For example, one assumption is the rational economic actor model (where a person makes logical, rational self-interested decisions that weigh costs against benefits and maximize value and profit to the person). Another assumption is that changing attitudes will change behavior.
Lead Author: Michael Sullivan (Freeman, Sullivan)

• Behavioral assumptions underlying energy efficiency residential programs
This white paper will examine the assumptions underlying the design and implementation of energy efficiency programs and the basis and validity of these assumptions in the residential sector. For example, one assumption is the rational economic actor model (where a person makes logical, rational self-interested decisions that weigh costs against benefits and maximize value and profit to the person). Another assumption is that changing attitudes will change behavior.
Lead Author: Loren Lutzenhiser (Portland State University)

• Market segmentation and energy efficiency program design
This white paper will examine how market segmentation (a) is currently being used in the design of energy efficiency programs in California and elsewhere (including the prioritization of selected market sectors), and (b) could be used or improved in the design of future energy efficiency programs in California. Targets of market segmentation include residential, commercial, and industrial customers — including existing and new construction.
Lead Author: Steven Moss (M.Cubed)

• **Experimental design for energy efficiency programs**
This white paper will examine how experimental design (a) is currently being used in the design and implementation of energy efficiency programs in California and elsewhere, and (b) could be used or improved in the design and implementation of future energy efficiency programs in California. This paper will include a discussion of competition among companies, communities, schools, etc. for promoting energy efficiency.
Lead Author: Stephen George (Freeman, Sullivan)

• **Motivating policymakers, program administrators, and program implementers to pursue behavioral change strategies**
This white paper will examine how policymakers, program administrators, and program implementers can be motivated to pursue behavioral change in a regulatory environment. The focus will be on the installation of energy-efficiency technologies, but lessons learned from other programs will also be addressed. The white paper will develop a framework with policy options for motivating policymakers, program administrators, and program implementers to pursue behavioral change.
Lead Author: Karen Ehrhardt-Martinez (ACEEE)

• **Encouraging greater innovation in the production of energy-efficient technologies and services**
This white paper will examine how greater innovation in the production of technologies and services can be encouraged through the development of innovative programs and policies. This paper will provide greater insights into the mechanisms that catalyze innovative behavior and that result in new technologies and services, increased energy efficiency, and reduced energy consumption.
Lead Author: Skip Laitner (ACEEE)