1A: Lightning: Workplace

Moderator: Edward J. Wisniewski, CEE

Speaker: Douglas Miller, Rocky Mountain Institute

Behavioral Opportunities for Energy Savings in Office Buildings: A London Field Experiment

Barring a transformational breakthrough in the near future in investment for and the use of non-fossil fuel energy sources, energy efficiency serves as a crucial climate change mitigation strategy. Office buildings are a major and growing source of energy consumption and carbon dioxide (CO2) emissions. Unlike physical improvements to buildings, behavioral strategies have the potential to reduce energy consumption in office buildings to be adopted promptly and at relatively low costs. In order to contribute to needs in the emerging field of research on the role of behavior change in office buildings to reduce energy use and related greenhouse gas emissions, a controlled field experiment including about 1,100 participants was conducted from July to August 2013 in five organizations across four office buildings in London, UK. The aim of the field experiment was to evaluate the effectiveness and 'stickiness' of behavior change interventions in private, public, and university office building settings that facilitate new expectations among employees – i.e. workplace norms – and therein modify the individual decision making context. The specific objective involved in the experiment was to increase the number of computer monitors turned off by employees during non-working hours. The change in behavior was therefore – in the literal sense – within an arm's reach of employees: pressing the power button on monitors. The behavioral intervention sought to modify the choice context by creating new expectations and norms through invoking either public commitment or social comparison. Data was collected in the form of observational (proportion) data from on-site visits of the number of monitors left on/turned off during non-working hours and in the form of electricity meter readings. The results of the experiment suggest that the facilitation of new expectations and workplace norms among employees significantly increases the adoption of energy saving behavior in office buildings. To evaluate the observational data results, a quasi-binomial generalized linear model was used and demonstrated that the behavior change intervention led to a statistically significant increase in the monitors turned off during non-working hours. Public commitment and social comparison were equally effective in facilitating behavior change. Differences in the impacts of the intervention across private, public, and university buildings as well as within organizations were insignificant. To evaluate the electricity meter readings, a general linear model was used and as expected – due to the relatively small amount of electricity consumed by computer monitors – the behavioral intervention did not significantly affect overall building electricity use. Even so, the meter readings highlighted the significant role of energy efficient technologies and materials in reducing office building energy use during non-working hours. The experiment provides insights that potentially can be applied to other and larger sources of energy use in office buildings. With a minimal set of conditions being met, small interventions can compel dramatic increases in energy saving behaviors. Recommendations are offered for policymakers to spur the adoption of energy saving strategies in office buildings and thereby better capture the low-hanging fruit of mitigation opportunities to reduce the scale and scope of impacts expected from climate change.

1A: Lightning: Workplace

Moderator: Edward J. Wisniewski, CEE

Speaker: Russell Barnett, University of Louisville

INSTITUTIONAL BEHAVIOR CHANGE AND SUSTAINABILITY

Public institutions have made commitments, organized, and implemented programs with the goal of being more sustainable. Efforts to become more sustainable, however, too often focus on technology, and any focus on behavior is typically on changing individual behavior. Working within an existing collaborative partnership between the City of Louisville, the local school district, the local community college and the University of Louisville, the Partnership for a Green City has developed strategies for the four partners to change institutional behavior. Specific behavior changes were prioritized by each partner. The focus areas identified were in energy use, employee and student health, waste and recycling, and alternative transportation. Behavior change teams were identified by each partner. Two University classes focused on the psychology on behavior and sustainability provided academic assistance to the teams to identify opportunities for each partner to pursue. Research has identified eight principles necessary for institutions to change behavior: provide a social network and communications on those behaviors desired to be sustainable; provide multiple motivations; provide visible leadership; make definitive, public commitments to change; provide actionable information and feedback; set desirable social goals and empower employees and students; and plan for continuous change. The Partnership has used these principles to identify how the lack of institutional support has not supported behavior change. The behavior change teams from each of the four institutions have identified specific behaviors for change and developed programs to support behavior change.

1A: Lightning: Workplace

Moderator: Edward J. Wisniewski, CEE

Speaker: Mary Beth Deline, Cornell University

Framing Resistance to Energy at Work

Although the IPCC has identified the commercial energy sector as one with the most likelihood to significantly reduce consumption and emissions, there is still a systemic lack of research into socio-cultural influences on organizational energy behaviors and decision-making. This study begins to address this gap. It is an exploratory case study that examines how frames and social roles contribute to resistance interpretations on the part of implementers during the implementation of an energy conservation campaign in the workplace. Frames and social roles are theorized to act together as forms of socio-cultural influence within workplace organizations in making interpretations. Frames are the shared expectations used by different groups or collectives to interpret situations and social roles are socially expected behavioral performances. Implementation decisions in particular, as opposed to adoption decisions, are understudied; this is problematic given implementation failure rates in general as high as 70%. Essentially we know what behaviors bring about change, but still do not understand how to successfully encourage implementation of these behaviors. Practitioners and researchers traditionally ascribe these failures to employee 'resistance', rather than viewing the coping behaviors employees undertake when confronted with an implementation as a form of engagement. (Coping behaviors are actions related to the change. For example, one such form of coping behavior is information seeking). This suggests a conflict between employee and implementer interpretations of resistance that might be key to better understanding implementation processes within workplaces, and subsequent ways to improve it. In order to better understand this process, research questions for this study include: 1) What are the differences between implementer and employee frames of energy conservation at work?; 2) How do energy and conservation behaviors fit or not fit into worker's and implementer's social roles at work?; and 3) What are the frames that implementers use when making resistance interpretations of employee coping behaviors in relation to energy conservation programs? In particular, this work investigates an educational organization in the Midwest that recently implemented a conservation program with a 42% participation rate. Respondents, who were self-selected, ranged from active to less active conservation participants. Data collection reached saturation through qualitative semi-structured interviews with 35 employees, including 39% of the program implementers. The study uses constant comparative analysis to identify key frame and social role categories used by the participants and implementers when putting the program in place. The findings are enriched with pre and post survey data and participant behavioral data provided by the conservation program. This topic necessarily requires an approach that integrates organizational energy behavior, implementation communication and decision research. Addressing gaps in these areas provides several benefits. First, the research shows how socio-cultural influences structure energy behaviors within organizations. This extends the decision-making approaches that have, to date, been used within the energy research field. In addition, the paucity of such socio-cultural research constrains evidence-based efforts to reduce energy consumption. This research leads to specific recommendations for implementation communication strategies regarding energy conservation in particular and eco-innovations in general.

1A: Lightning: Workplace

Moderator: Edward J. Wisniewski, CEE

Speaker: Michael Bobker, Building Performance Lab, City University of New York

Operator Effectiveness with Building Automation: Information and Action

Our research explores the relationship of building operator decision-making with new data environments through an on-going series of engagements in surveys, interviews, data experiments, and classroom settings. The objective of the work is to identify how operators perceive and adapt to emerging data tools, especially those based on Building Automation Systems, and where they can bring about improvements in operating practices related to energy efficiency. We will discuss our approach to creating a consistent set of operating practice behaviors across a portfolio of buildings and findings from initial experimental experience. Controlling and monitoring HVAC equipment is essential to any energy management program. If you cannot control when and how equipment will operate, you cannot control energy cost. The performance of large commercial-institutional buildings is especially subject to the practices and decisions of a small number of operating engineers. A building automation system (BAS) is an essential tool that operating engineers use to manage systems. While a large amount of building operator work now revolves around controlling and monitoring through the BAS, there are no industry protocols or established best practices for their use; each operating team develops their own way of using the BAS. Even within a building, individual members of the engineering staff may have different approaches for viewing system status and interpreting conditions. To explore developing a consistent protocol amongst engineering staffs, CIUS Building Performance Lab (BPL) is actively partnering with the Pacific Northwest National Lab (PNNL) and Vornodo Realty Trust (VNO) to investigate operator behavior in utilizing their BAS. Existing behavior is captured by survey, interview, and discussion in training classes. Intervention is designed to provide selected data visualization tools, based on the PNNL Building Re-Tuning protocol, with observational and interview follow-up to assess the effectiveness of the new data tools. This specific experiment with new data tools is part of a larger on-going data collection project on Building Operating Engineer self-perceived practices, conducted in connection with our training program and believed to be the largest data set of its kind. The VNO experiment will be the main case study for this presentation. This is a small scale qualitative research project to see if a larger scale research effort would be justified. The experiment involves 5 -10 VNO buildings. We conducted a survey across VNO's NYC portfolio to understand how the operators work with their BAS. A sample of operators was then chosen for more in-depth interviewing on site to better see how they control their buildings, specific operating sequences that they employ. BPL's Building Automation System Assessment Tool (BASAT) was run at each site to evaluate control and monitoring capabilities under the current sensor deployment and then compared to operator practice. Based on the interview and BASAT findings, selected new data tools were introduced for operator use and evaluation. The new tools develop data visualizations from trend logging, utilizing ECAM (Energy Charting and Metrics tool suite) and are informed by PNNL Building Re-Tuning as a structure for consistent energy-related practices for HVAC systems.

1A: Lightning: Workplace

Moderator: Edward J. Wisniewski, CEE

Speaker: Jamison Donovan, Department of General Services

The Sprint to Savings Leveraging partnerships, competition and incentives to catalyze behavioral change at schools

In February 2014, the District of Columbia's Department of General Services, in partnership with other government agencies and the local branch of the USGBC, launched a three week energy competition, the Sprint to Savings, to teach students about energy and sustainability while reduce electricity costs at its public schools. Twenty eight schools signed up from across the city's eight wards. Using online leaderboards updated with 15-minute interval data, schools were able to monitor and track their progress—a critical feedback mechanism. At the end of the three weeks, twenty four of the participating schools succeeded in reducing their electricity consumption. The winning school reduced its consumption by 30 percent! Overall, their efforts saved over 76,000 kilowatt-hours of electricity—enough to power seven American households for nearly an entire year. The competition was designed to engage building occupants—including students, engineers, custodians, administrative staff and teachers-- in reducing their facilities energy consumption. While there are other schools that have engaged in three week electricity consumption competition at the district and national levels, the DC competition is distinguished by three innovative features: engagement of local energy and building professionals, customized electricity baselines and financial incentives. • Engagement of local energy and building professionals: by partnering with the local chapter of the USGBC, we enlisted the help of over 50 building professionals to work with teams of students at the participating schools. The mentors, among other things, taught children about energy, its impact on the environment and techniques to conserve energy and supported student led building audits. This was an invaluable resources and fundamental to the program's success. • Customized electricity baselines: customized baselines were created for each participating school, which allowed for a more accurate competition. Given the unseasonably cold winter, this was crucial in ensuring a fairer competition than if traditional baseline models were used. • Financial incentives: As part of the program, schools were eligible to receive financial rewards if they hit certain thresholds. This proved a motivation factor for schools that find it increasingly difficult to find time for activities that are explicitly included in the curriculum. The Sprint to Savings offers an innovative and creative model for targeting occupant behavior at school districts across the country. The presentation will briefly summarize the competition's innovative design but will focus on the lessons learned from the competition and how these lessons can be used to more effectively target occupant behavior.

1A: Lightning: Workplace

Moderator: Edward J. Wisniewski, CEE

Speaker: Amir Danak, Pulse Energy

Classification of Business Categories for Small and Medium Enterprises

Developing energy-saving recommendations that encourage participation of small and medium size enterprises (SMEs) is challenging due to the diversity of business categories in this sector. More precisely, the energy consumption profiles of individual businesses depend on a diverse set of factors that vary significantly between different business categories within the SME sector. The environmental and operational conditions, such as the ambient temperature and days and hours of operation, affect the energy usage of SMEs in divergent ways; Hence identifying the category of a business is fundamental in the effort of deriving and suggesting of actionable energy-saving measures. Categorization of businesses is typically a highly manual task, that either requires a large investment of human resources, or subscribing to a third party database. In this paper, we propose a classification mechanism for identifying the business categories of individual SMEs based on statistical analysis of the historical smart-meter data and text mining of the customer meta data (e.g. business name, address). Our solution is based on two machine learning schemes: Firstly, major segments of the SME market are identified using unsupervised learning (clustering), which is based on the similarities between energy consumption patterns of businesses. Each cluster constitutes businesses with similar energy use profiles, whose behavior is distinguished from those in other segments. A number of distance measures are defined to best represent the similarities between businesses in each segment. For example, the weekly operating schedule is used as one such distance measure, to differentiate between business categories. The optimal number of clusters is determined based on external evaluation of the clustering results given partially-labeled billing data, a subset of businesses with verified business type. Secondly, after the major clusters have been identified, supervised learning algorithms are applied to each cluster, in order to classify SMEs into subcategories that describe the business type more accurately (e.g. distinguishing fast food from regular restaurant). We trained and cross-validated the first part of the classifier (clustering using electricity data) on a dataset of 50,000 SME customers each having one year of 15-minute electricity interval data, and obtained prediction accuracy of 85% for classifying businesses into one of eight major segments based on historical energy use data. The second part of the classifier (text mining of meta data) allows further classification into a set of 80 sub-categories. This work shows that the important task of identifying the business category of SMEs can be automated using customer energy and meta data. Such an automated process promises to vastly reduce costs, removing a major barrier in the effort for utilities to better understand and engage the SME sector in energy saving programs, allowing for better targeted recruiting, improved benchmarking, and more accurate measurement and verification (M&V) of energy savings.

1A: Lightning: Workplace

Moderator: Edward J. Wisniewski, CEE

Speaker: Bruce Ceniceros, Sacramento Municipal Utility District

Walk the Talk: Changing Behavior Within Your Own Organization

Has your organization developed core expertise in the social sciences and celebrated successes in behavioral program design and implementation? Then it is time to apply your experience in other areas of your company operations. Doing so can make those operations more effective, improve employee health and retention, and enhance the reputation of the utility with customers. These are the lessons learned when the Sacramento Municipal Utility District applied what they learned in their Home Energy Reports, In-Home Displays and Smart Thermostat programs to their general advertising activities, employee safety program, and employee Rideshare program. While the leads for these programs had been using behavior change tactics for years, consultation with the behavioral subject matter experts from SMUD's energy efficiency programs yielded many opportunities for enhancing the effectiveness of their efforts, such as using prompts to greater effect, employing normative comparisons, and improving messaging. In the process, the energy efficiency program planners are learning valuable lessons through the opportunity to experiment with a wider variety of practical applications—lessons that can be applied back to the energy efficiency programs. They are also gaining a deeper understanding of the customer experience because we (the employees) are now the guinea pigs. In this presentation you will see examples of messaging and prompts from SMUD's employee safety campaign before and after systematically applying tools from the social sciences to better meet program objectives. We will also share data that reflects the impacts resulting from this behavioral campaign, which aims to reduce unsafe behaviors that have been associated with injuries on the job.

1A: Lightning: Workplace

Moderator: Edward J. Wisniewski, CEE

Speaker: Susan Hunt Stevens, WeSpire (formerly Practically Green)

CSR + Sustainability = Behavior Change That Works

Engaging employees in sustainability initiatives can drive measurable behavior change in the areas of transportation, waste, water and energy use that leads to both better environmental and financial performance. But what many sustainability practitioners may find surprising is how the most effective programs include components of social impact (health, volunteering, citizenship). This lightning (or longer) presentation will share data that compares the "impact per participant" of 20+ programs. The data will showcase the difference between those focused exclusively on traditional sustainability categories versus those that also included social initiatives. It will also present a predictive model for estimating the potential environment, human capital and financial benefits of a workplace program. About WeSpire (formerly Practically Green) WeSpire helps companies engage people in sustainability and responsibility initiatives with persuasive technology that builds awareness, drives behavior change and measures business results. The award-winning engagement platform, used by leading global corporations including MGM Resorts, eBay, McDonald's, Unilever, Caesars Entertainment, EnerNOC, and NBC Universal, pairs expert content with proven social and game mechanics to make embracing new habits simpler, faster and more fun. About the Authors Susan Hunt Stevens is the Founder & CEO of WeSpire. She is a recognized expert in the use of social and game mechanics to drive positive behavior change in sustainability and social responsibility. Previously, Stevens spent nine years at The New York Times Company, most recently as senior vice president/GM of Boston.com, one of the largest news and information sites on the web. She is a graduate of Wesleyan University and The Tuck School of Business. Aaron Graves is the CTO of WeSpire. He and his team use customer insight and analytics to design and build a mobile and web platform that delivers measurable behavior change at scale. Previously, Graves was a senior software engineer with LevelUp and MetaCarta. He is a graduate of Boston University.

1A: Lightning: Workplace

Moderator: Edward J. Wisniewski, CEE

Speaker: Elizabeth Denton, Arlington Transportation Partners

Listening to Champions: Using Marketing Research to Influence Transportation Benefits

Research shows that organizations that offer transportation benefits are more successful at getting people to drive less. Arlington Transportation Partners, a business-to-business division of Arlington County's Commuter Services, continually seeks to increase adoption of transportation benefits to encourage multimodal travel. Inspired by community-based social marketing and lessons learned at BECC in 2012, our organization and research team leveraged the value of market research to improve our engagement with clients, and the results are coming in. In 2013, ATP launched a pilot called "Workplace Commute Champions" (WCC), which engaged our clients in a program that rewarded them with publicity and prizes for offering transportation benefits and amenities to their populations. The program engaged 31 clients to participate over a four-month period, and rewarded representatives from the "winning" clients with recognition at a County Board meeting, as well as tickets to a sporting event. Following the trial period, ATP held three focus groups to obtain feedback from both WCC participants and clients that did not participate. Issues that arose included lack of guidance on what the "levels" and their actions meant, confusion about "who" the game was for, and uncertainty about how to "win." Based on feedback, ATP altered the program before re-launching it as "ATP Champions." Changes included: 1) Changing the actions required for each "level" from an impact-based scale (used by regional transportation planners) to one of difficulty and cost to implement (placing easiest actions on the lowest levels); 2) Providing icons to indicate the aforementioned difficulty level and cost to each action; 3) Clarifying the rules of the program, such as timeline, how to progress, and the different recognition prizes for different levels; and 4) Revising the branding of the program to directly address the audience responsible for progress in the program. Lastly, recognition was the hallmark motivator from the focus group participants and as such, progress will reward the individual "champion" and company with recognition, increasing publicity at higher levels, and the sporting event prize was removed. These changes are anticipated to increase program recruitment and participation by resolving motivational and structural barriers, and leveraging the recognition that participants said they value most. The new iteration of the program launched in March 2014 and will continue through this November. ATP is collecting the following metrics to determine the success of the program: number of current clients who sign up; number of new clients; number of levels advanced; number of clients who add new transportation benefits; and the number of additional contacts within each company that engage with ATP. By December, we will have results to share at the BECC conference to show how market research into clients' needs, barriers and motivations, impacted engagement as compared with our pilot and other ATP programs. Arlington Transportation Partners and the research-arm, Mobility Lab, are Arlington County Commuter Service's business-to-business division, supporting programs and services that make it easier for people who live, work, or play in Arlington County, VA to get around without a car.

1B: Core Issues in Behavior

Moderator: Michael Sachse, Opower

Speaker: Jack Yates, University of Northern Iowa

Persistence in Residential Energy Use Behavior Change

When homeowners make changes in their energy use behaviors under programs that include incentives, such as competitions, will those behaviors persist after the incentives are taken away when the competition ends? Using a 2012 energy conservation competition in four small Iowa communities that employed social and cognitive science behavior change principles to encourage greater energy efficiency, researchers from the University of Northern returned to the communities 1½ years post-competition to answer that question. The 2012 competition resulted in energy savings across the four communities of 4% electric and 10% gas. We observed substantial differences in the amount saved across communities - the top community saved 15% gas and 12% electricity. In general, persistence of energy use behavior changes is rarely measured and, when it is, the periods tend to be relatively short – weeks or a few months -- and at a small unit of analysis – building, institution, or dwelling. The current project measured persistence over a longer period of time (1½ years after the competition) and used the small town as a unit of analysis. Researchers used a follow-up survey to ask participants which energy savings actions they continued to take. They also conducted personal interviews with some community residents to learn why participants continued trying to save energy or why they did not continue their actions started during the competition. Aggregate community electric and gas data from local utilities for 1 ½ years after the competition ended were also collected. Responses from these data were compared to the survey data collected during the competition and community gas/electric data collected since 2010 to determine the significance of persistence in residents' energy use behaviors. Given the number of small communities in the United States and the number of energy competitions held in dorms, buildings, neighborhoods, and communities, understanding persistence in energy change behaviors can provide information for modifying competitions, advancing local government policies, and expanding opportunities in numerous settings to further understand organizational behavior to reduce energy usage, greenhouse gas emissions, climate change, and increase sustainability.

1B: Core Issues in Behavior

Moderator: Michael Sachse, Opower

Speaker: Wokje Abrahamse, Victoria University of Wellington

Social influence and behaviour change: A meta-analysis

Social influence occurs when our behaviour is affected by what other people think, or do. Insights from theories of social influence are increasingly being applied as part of interventions to encourage behaviour change, such as the use of social norms and social comparison. But how effective is social influence at encouraging environmentally friendly behaviours? This study compares the effectiveness of different social influence approaches, such as the block leader approach, modelling and social norm information to encourage environmentally friendly behaviours. A random-effects meta-analysis with a sample of 27 studies revealed that social influence approaches were effective when compared to a control group. They were also more effective when compared to another intervention, though the effect size was small. The effectiveness was different for different social influence approaches and for different target groups. These findings raise a number of important questions, which form the basis of a research agenda for better understanding the processes through which social influence affects behaviour change.

1B: Core Issues in Behavior

Moderator: Michael Sachse, Opower

Speaker: Dan Ohlendorf, PG&E

Business Energy Reports: 2013 Follow-up to review energy savings & key findings

In 2013, Pacific Gas and Electric Company launched Business Energy Reports to help over 15,200 small and medium sized business (SMB) customers across 23 different industry segments throughout Northern and Central California reduce gas and electric energy consumption. Business Energy Reports are printed energy analysis reports mailed directly to SMB decision-makers that provide normative comparisons to similar businesses. In order drive behavioral actions with business owners and their employees; these reports incorporate customized industry specific messaging, tiered usage comparisons to similar businesses, report-over-report energy conservation performance tracking, educational tips, how to guides, estimated end-use disaggregation, load shifting during peak and partial peak times of day, and personalized energy saving recommendations ranging for equipment upgrades to no-cost best practices. These reports are generated, printed, and mailed by Pulse Energy on behalf of PG&E. This session will provide a brief overview of the program, share energy saving results calculated using a Randomized Control Trial (RCT) experimental design, and key metrics and learnings. The presentation will help inform utilities, program evaluators, technology vendors, industry experts, and policy makers on how successful future full-scaled SMB behavioral programs can be towards helping California and other states conserve energy.

1C: Achieving Persistent Savings

Moderator: Page Gravely, At Site

Speaker: Kathy Kuntz, Cool Choices

It's Complicated: Unpacking Behaviors to Estimate Persistence

Increased lighting and appliance standards have reduced the savings opportunities for traditional efficiency programs, facilitating an increased interest in behavioral programs. As more jurisdictions consider adding behavior programs to their energy efficiency portfolios there are questions about the persistence of behavior change. Initially programs have presumed that behavioral savings decay quickly—that behaviors will revert once program interventions stop. As a result, many efficiency programs presume that behavior savings persist for just a year. Recent analysis suggests, though, that these estimates are conservative—that some portion of the savings persists longer than a year. It is, of course, enormously difficult to characterize persistence when we're talking about 'behavior', a vague term that includes a variety of specific actions that might be one time, seasonal or habitual. Clearly there would be benefit in approaching the issue of persistence from the other direction—looking at what behaviors households adopt and estimating the likely persistence of each behavior, just as we estimate the persistence of CFLs, furnaces and other measures. In this presentation Cool Choices will use data collected from thousands of households to illustrate an alternative approach to persistence. Instead of a top-down approach to estimating persistence, we will show how one can use data to build a bottom-up estimate that can be verified through utility billing analyses. Beginning with a brief overview of the data we collect, we will demonstrate strategies for estimating persistence at the specific behavioral level with special attention to the various kinds of behaviors households adopt. We argue that there is good rationale for differentiating seasonal actions (like turning up the temperature for the air conditioning) from various kinds of habitual actions (washing in cold water vs turning off lights, for example) and actions that might be considered permanent. Then, following the discussion of types of behaviors, we will illustrate how this methodology can be used to estimate persistence more comprehensively, using data from several Cool Choices games to illustrate the process. The presentation will encourage attendees to think about persistence in a more nuanced way and help to advance the broader conversation about the role of behavior programs in an energy efficiency portfolio.

1C: Achieving Persistent Savings

Moderator: Page Gravely, At Site

Speaker: Olivia Patterson, Opinion Dynamics

The Adolescent Years of Behavioral Programs: Optimizing Behavioral Program Design through Energy Savings Persistence

Though behavioral programs are still a new concept in some jurisdictions, in others, they have reached their adolescent years. For certain behavioral program designs, we now know how much energy they can save in the first 1-3 years the program is running, but each program's trajectory afterwards is fairly uncertain. As with any teenager, we seek to provide parental (regulatory) guidance and support to make sure we're on the right track (consistent savings). One of the main questions that program administrators ask is, "how long do we need to treat people?" and "how often do participants need feedback?" in order to continue to achieve savings over time. There are many types of research that can help answer these questions, and in this presentation, we will summarize (a) the methods available for uncovering the answers to these questions, and (b) findings from a handful of studies, including our own recent research into the durability (short-run persistence) of an opt-out behavioral program. In the past few years, behavioral program administrators, implementers and evaluators have learned a lot about what behavioral programs can achieve, both in the short-run (while the program is operating) and in the long run (after it stops). We will discuss varying the frequency of treatment or length of time that the behavioral intervention continues, load disaggregation and end-use analysis enabled by AMI data, and self-report research. In particular, this research tells us how these programs are doing "in the field", and provides insights towards optimizing program design and "improving" savings outcomes. In summary, our presentation will illustrate what the research can tell you about what you can expect from your program. What actions are taken in programs? How savings are changing or decaying over time? And, do conditions exist for savings to persist beyond the program period? Findings from these programs in their adolescent years will help program administrator's better plan for their futures.

1C: Achieving Persistent Savings

Moderator: Page Gravely, At Site

Speaker: Heidi Ochsner, Cadmus

Persistence of Energy Management Activities in Commercial Office Buildings

Since 2007, the Northwest Energy Efficiency Alliance (NEEA) has offered the Market Partners Program (MPP), which engages the Northwest's commercial real estate firms to adopt strategic energy management (SEM) practices through an organizational consulting process. SEM is a holistic approach to reducing energy use that encompasses both efficient equipment and efficient behavioral activities. Requiring engagement from building staff at all levels, this approach is an ongoing process through which NEEA helps firms develop an action plan that the firm then implements and revisits over several years. This paper will present the results from a study of the persistence of SEM behaviors and savings at the MPP firms. This research is important because energy management programs are a relatively new method for obtaining additional savings from the commercial sector. Because most comparable programs are still in the pilot stage, there is little information about how long savings persist after a firm graduates from the program, particularly those savings associated with operations and maintenance and behavioral measures. Thus, studying savings persistence is important to supporting or revising the measure life assumptions that energy planners and evaluators use to assess the cost-effectiveness of these programs. As NEEA's MPP is one of the longest-standing SEM programs, it offers the opportunity to study persistence of measures during and after program engagement. For each firm and year of participation, we will use both quantitative and qualitative methods to assess persistence, and employ a regression model to estimate cumulative energy savings. One limitation of this analysis is that it cannot assign savings to individual projects or distinguish between savings generated by new projects and those generated from past projects. To address this limitation, we will interview staff members at the MPP firms to determine which activities remain in place from previous years. Through an assessment of interview responses coupled with firm-level savings results, research findings will inform the proportion of annual cumulative savings due to savings persisting from previous years. Interview responses will also provide insight into whether energy savings persistence is influenced by the extent to which behavioral SEM activities are implemented at the firm. It is envisioned these findings will provide essential insight into the relationship between behavior and energy savings.

1D: Telling Richer Stories with Technology

Moderator: Rebecca Ford, Victoria University of Wellington

Speaker: John E. Petersen, Oberlin College

"Community voices": Incorporating personal narratives as a component of multiscale real-time feedback to elicit pro-environmental culture change

"Sociotechnical" feedback employs technology to acquire, process, and deliver content that is intended to motivate and empower changes in thought and action. The term "ecofeedback" has been used when the goal is to elicit pro-environmental behavior. Prior research has emphasized translation and disambiguation of quantitative data on energy and water use into a visually compelling and easily interpretable form to motivate building occupants to conserve resources. However, making information meaningful and psychologically motivational can be conceptualized as a kind of storytelling process that uses data on individual and community performance as a key narrative element. From this perspective the particular changes in thought and behavior that result can be seen as a function of the the narrative construct. We know that the effects of direct ecofeedback on resource use in individual buildings can be enhanced when combined with environmental, economic and social contextualization, including the use of social norms. Beyond conservation in buildings induced by direct feedback, deeper psychological and cultural transformations are necessary to bring about behavior change at the level of political, economic and broad-scale ecological decision-making. Can the narrative construct of ecofeedback be developed to motivate multi-scale change in thinking and behavior? "Environmental Dashboard" is a technology and approach that combines three scales of ecofeedback to build motivational narratives related to resource consumption and its impact: 1) "Building Dashboard" delivers socially, environmentally and economically comparative information on resource consumption in individual buildings; 2) "Citywide Dashboard" is a conceptual model animated with real-time data that provides feedback on resource flows and environmental conditions in whole communities and organizations; 3) "Community Voices" combines images and words drawn from the full diversity of communities to celebrate thought and action that build a shared vision and identity around a sustainable future. In a pilot project in Oberlin Ohio, digital signs have been installed in schools, store fronts, and in community organizations to provide a delivery venue that cycles through all three components and incorporates a community calendar and site-specific content associated with each location. A key premise of the community voices component is that inclusively identifying and celebrating the pro-environmental thought and action within a diverse community is a crucial mechanism for building social norms, personal identity and a shared vision of a sustainable future. Narrative content in community voices is divided into six categories that emphasize content related to: neighbors, children, nature, community service, and local economic development. Our initial findings indicate that the process of interviewing and then sharing the messages of community members enhances pro-environmental identity. This talk will explore the extent to which exposure to messages in each of the six categories changes people's perceptions of community-level progress on social, economic and ecological dimensions of sustainability. We will also present findings related to whether message content delivered in the voice of children has a different impact than similar content associated with adults. Ultimately, our goal is to develop all three components of environmental dashboard as an integrated off-the-shelf technology that can be adopted by other communities.

1D: Telling Richer Stories with Technology

Moderator: Rebecca Ford, Victoria University of Wellington

Speaker: Brian Jackson, Apogee Interactive, Inc.

Energy Communication Goes Hollywood: Moving the Masses with Personalized Movies

Video is one of the most engaging forms of content. AT&T, Cox Communication and other major companies have deployed this revolutionary new information delivery method to deliver ads and explain bills, and it is proving effective at raising customer satisfaction and reducing costs. eMarketer predicts that U.S. online video spend will climb from $4.14 billion in 2013 to $8.04 billion by 2016, so this is a wave to watch. Video is also the most responsive medium for portable devices because it easily sizes to any device. While other industries are using this method to deliver static information, Apogee is applying this "smart video" technique to analyzing and explaining energy utility customer's bills on the fly, accounting for weather impacts, days of service, rate changes and other considerations that can cause bills to change, thereby answering customer's questions at the point of bill delivery and avoiding costly contact center calls. The same methods can be used to deliver outage and emergency information or for making program participation offers with the advantage of being customized to each customer's unique situation and only offering programs that fit the customer's home or usage profile. In 2013, a team of Apogee developers embarked on taking our popular billing-integrated online energy analysis tools and using it as the basis for creating contextually-relevant movie presentations delivered in real time. After perfecting the production path with a prototype in January, they are currently deploying it with three utility clients to gain experienced with this powerful new concept. It is a personalized video presentation of my bill explained intuitively to me and perfect for our sound-bite driven society. No thinking required. Beyond bill analysis and explanation, smart videos can be used for: • Communicating rate increase impacts, wholesale power adjustments, • Personalized offers for home improvements, • Attracting participation in rebate and other programs appropriate for that customer's situation, • Explaining outage details with specific information (restoration times, Outage causes, other crisis messaging).

1D: Telling Richer Stories with Technology

Moderator: Rebecca Ford, Victoria University of Wellington

Speaker: Cynthia McPherson Frantz, Oberlin College

Feedback technology can increase connection to nature and enhance systems thinking

A broad cultural shift toward sustainability will require (among other things) fundamental changes in the way individuals conceptualize themselves and their behavior in relation to the natural world. Feedback technology has the potential to facilitate this by promoting understanding of resource flows, expanding awareness of personal and collective impact on and responsibility for the environment, and enhancing a sense of connection to the natural world, all of which reflect various components of what can be termed systems thinking. In two separate studies, we tested the extent to which systems thinking might be enhanced through the use of a novel form of feedback technology -- the "City-wide Dashboard" (CWD). City-wide Dashboard is a web-based conceptual model of a city that is dynamically animated by real-time data on water and electricity flows and environmental quality. Viewers see an individual in his or her home situated in a landscape that depicts the infrastructure responsible for providing their daily resources: an electricity power plant, wastewater treatment plant, the freshwater source, electricity wires, water and sewer lines. The rate of community-wide resource use is depicted in real time with animated flow lines. Displays provide real-time information about water quality, community-level carbon emissions, and current weather conditions. In Study 1, we exposed half of our participants to the "City-wide Dashboard" (CWD); the other half viewed a "Pacman" control that presented identical information and eye-catching animation, but without the conceptual model of the resource system (duration = once a day for 1 week, N = 89). Several measures were used to assess the impact of the technology on systems thinking: participants' sense of being a part of the natural system (connectedness to nature); the extent to which they saw long chains of causality in particular events, and the extent to which they ascribed broader rings of responsibility for those events. Participants exposed to the CWD increased in connectedness to nature. For those who began with relatively low connectedness to nature, systems thinking was enhanced by exposure to the CWD; those high in connectedness to nature were not affected by exposure. Participants low in connectedness to nature also increased their tendency to see causal connections between events, and to ascribed broader rings of responsibility in understanding events. Thus, those not already connected to the natural world demonstrated increases in systems thinking after exposure to the CWD. In Study 2, an online sample of adults (collected through mTurk, N = 202) interacted with the CWD or a control display for approximately 2 minutes, and completed a different measure of complex causal thinking. Participants in the CWD condition demonstrated more complex and holistic causal thinking, relative to controls. Together these findings suggest that feedback technology can in fact shift the way people see the world, even when exposure to the technology is of limited duration. Related research has demonstrated a negative correlation between connectedness to nature and electricity use. A key next step is to assess whether increases in systems thinking are associated with changes in resource use.

1D: Telling Richer Stories with Technology

Moderator: Rebecca Ford, Victoria University of Wellington

Speaker: Beth Karlin, University of California, Irvine

FloodRISE: An Interdisciplinary Approach to Leverage Technology for Resilience

This presentation will introduce and share insights from the NSF-funded Flood RISE project, a four-year effort to develop and test parcel-level flood models for improved community resilience. For decades scientists have tried to characterize what they know about climate change and translate it into actionable information. By most metrics, this effort has failed. Emissions continue to increase, climate change impacts are tracking worst-case scenarios, and skepticism about climate change is at an all time high. The poor response to climate change science is consonant with research that shows that top down communication of information that is often abstract and outside the immediate experience of the audience tends to have very little impact on behavior. Flood RISE convenes an interdisciplinary team of researchers to understand the type of information that is needed to catalyze climate adaptation behavior related to flooding, investigate and test communication strategies, identify interventions that can be implemented to build community resilience and mitigate expected losses, and model how these interventions can affect flood hazards and their expected impacts. Significant advances have been made in hydrodynamic modeling capabilities for natural disasters such as floods. In light of these advancements it is vital to better understand how to effectively design risk communication strategies that best utilize the outputs of these models and promote hazard preparedness and mitigation and, therefore, increase overall community resilience. The basic hypothesis of Flood RISE is that such dynamic parcel-level models showing data via transformative communication strategies can serve as a more powerful tool for people to understand vulnerability, visualize risk, and plan for future hazards than coarse-level modeling conveyed via a singular disaster narrative. To test this hypothesis, a hydrodynamic parcel-level model developed for the project was tested against static maps from FEMA (Federal Emergency Management Agency) to determine the impact of detailed flood knowledge on perception and behavior related to flooding. Results indicate that viewing the Flood RISE model leads to greater understanding of risk as compared to the FEMA maps ($t = 2.875$, $p < .01$) with participants reporting increased knowledge as to the specific area and potential depth of flooding in their area. Preliminary survey data also indicates that community residents feel relatively uninformed and unprepared with regard to potential climate-related flooding and are interested in learning and acting to improve resilience but unaware of how to go about it. Building from these preliminary findings, the team will be working with community stakeholders over the next three years to educate and empower residents of flood-vulnerable communities through collaborative workshops and interactive digital content designed to transfer knowledge, facilitate two-way communication, and evaluate and act on appropriate resilience options. This project fosters innovative interdisciplinary science that builds a broad knowledge base for flood resilience, articulates a strategy for more effectively translating climate science into actionable information to catalyze behavioral change, and advances understanding of whether and to what extent parcel-level data can contribute to more resilient communities.

1E: Innovations in Evaluating Behavior Programs

Moderator: Carol White, National Grid

Speaker: Bill Provencher, Navigant Consulting

Behavioral Effects of a Smart Phone App to Provide Real-Time Energy Use Information

This study presents impact results and customer analytics for an opt-in residential behavioral program in a large utility in the Midwestern United States in which participants with smart meters are able to remotely monitor their energy use on an hourly basis. The app allows the customer to access energy efficiency tips with investment details ("project cards"), set goals, compare home energy use to past use, and accumulate rewards points for energy savings. The program was initiated in April 2014. Results will be available in November 2014. Several features distinguish the program and its evaluation. First, a survey of participants and matched controls—customers who are observationally equivalent to participants –will provide unique insight to the issue of self-selection bias, which is a perennial issue with opt-in programs. Second, the survey of participants and their matches will be used to identify the behavioral effects of the program using a unique battery of "in-the-moment" questions about energy use that we argue is superior to traditional survey questions to identify behavioral responses with a survey. Third, the survey and analysis of in-app analytics will identify the drivers of program participation and the types of customers opting to participate in the program, and examine how participants engage with the app, including how their engagement patterns tie to their energy use. Fourth, via a randomized controlled trial (RCT) some customers are provided the opportunity to increase the information content of the program via the installation of hardware at the residence (a "bridge") to allow the customer to monitor household energy use on a minute-by-minute basis. The RCT design allows a "clean" examination –an examination free of the issue of selection bias –of how the bridge affects energy savings, use of the app, and customer satisfaction with the program. Finally, a choice experiment survey will be used to determine customer average willingness to pay for the bridge by customers without the bridge, and how this varies with the intensity of use of the app, annual energy use, and other customer characteristics.

1E: Innovations in Evaluating Behavior Programs

Moderator: Carol White, National Grid

Speaker: Jane Hummer, Navigant Consulting

Quantifying Behavioral Spillover: the Overlooked, Uncounted Source of Program-Influenced Savings

A key challenge in energy program evaluation is assessing the full range of a program's influence on the participant. Many utilities design their residential energy efficiency programs not only to achieve immediate energy savings through the installation of energy efficiency measures, but also to increase customer awareness of other opportunities to save energy in their homes. While it is difficult to verify the energy savings resulting from participants' self-reported behavior changes using survey data alone, those savings can still be quantified, which provides valuable insight into a program's effectiveness at engaging and educating its participants and encouraging behavior change. Program evaluations which overlook the additional energy savings resulting from behavior changes (i.e., behavioral spillover) do a disservice to programs with strong educational and behavioral components. The research team developed and implemented a behavioral spillover estimation methodology for a suite of residential energy efficiency programs. The objective of this research effort was to develop a reasonable estimate of behavioral spillover savings using participant surveys without putting an undue burden on the survey respondents in terms of survey length or technical complexity of the questions. Using past survey results and secondary research, the research team identified the most common energy behavior changes reported by participants in residential energy efficiency programs. The research team then developed savings estimate calculators for each behavior change based on assumptions regarding baseline efficiencies and hours of use documented in the statewide deemed savings measure database, and identified the survey questions necessary to quantify savings. By systematically planning the data collection and analysis upfront, the research team was able to quantify behavioral spillover savings from four residential programs in a resource-efficient manner. Results reveal that programs that focus specifically on customer education and engagement do result in behavioral spillover, compared to programs designed primarily around equipment replacement. Participants in an energy kit and online audit tool program reported making behavior changes that result in approximately 3% of their program-reported electric savings and 24% to 28% of their program-reported gas savings. Participants in an in-home energy audit and direct installation program reported behavioral spillover of 1-2% of electricity savings and 3-6% of gas savings. Further, the savings from behavior changes often exceed the savings associated with equipment-based spillover (e.g., the installation of additional, unincented efficiency measures). Program evaluations are likely under-reporting savings attributed to these programs if the focus is limited to equipment-based spillover. The research team developed an innovative methodology that is logical, transparent, and easily applicable to a wide range of programs. This presentation will walk the audience through the entire research process, including selecting the behavior changes that participants are most likely to adopt, designing survey questions to reduce uncertainty about energy savings, developing calculators to estimate savings based on survey responses, conducting the analysis, and presenting the results.

1E: Innovations in Evaluating Behavior Programs

Moderator: Carol White, National Grid

Speaker: Ken Agnew, DNV GL

Opt-in Behavior Programs: Opting for the Unknown?

Objective: The purpose of this presentation/paper is to spark further discussion on the challenges of, and strategies for, evaluating consumption savings for opt-in behavior programs. This presentation/paper will condense a whitepaper produced for the CPUC on this subject matter. Results/Achievements/Concepts: Behavior programs' share of the energy efficiency portfolio continues to grow. Following the successful example of Home Energy Reports programs implemented by Opower, a wide variety of vendors and approaches has entered the market to meet this demand. Many of these new programs offer interesting alternatives to the Opower delivery model, but most of them are not organized as randomized controlled trial (RCT) experimental design. Several programs have an opt-in design where, for instance, participants voluntarily log into a web portal with energy consumption information and/or energy-efficiency-related materials. While self-selection bias is not a new problem for volunteer programs, it still presents a major evaluation challenge. The challenge of evaluating the new breed of "opt-in" behavior programs is exacerbated by the combination of relatively small and variable household-level savings along with the self-selection into the program. Measuring the impact of these programs in a manner that will pass muster with public utilities commissions may be especially challenging. This presentation will share key points from a whitepaper written for the California Public Utilities Commission detailing the challenges of evaluating opt-in behavior programs. The presentation will: • Provide an overview of the evaluation options for these kinds of programs, • Explain the challenge of self-selection and the resulting selection bias in models estimates, and • Offer conclusions and recommendations regarding how these programs should be evaluated. Worthiness: The success of this new generation of behavior programs will be measured with consumption impacts. However, there has been too little discussion thus far on the potential threats to the validity of these savings estimates. All energy program actors - utilties, implementers, regulators and evaluations - must understand the issues and develop strategies for addressing these concerns if these kinds of programs are going to fulfill their potential in the energy efficiency program portfolio.

1F: Next Generation Home Energy Reports vs Other Interventions

Moderator: Kate Scott, Energy Trust of Oregon

Speaker: Debbie Brannan, Navigant Consulting

The Evolution of Home Energy Reports – Are they better now than they were before?

Since the first Home Energy Reports in 2007, HER programs have been widely adopted in the United States. Recent years have seen an evolution of the design of HER programs, leveraging a multi-channel, multi-touch approach, making information more accessible to tech-centric participants and moving participants along a continuum of involvement in home energy management. Initially HER programs were limited to a single touch point, paper mail reports, though many programs have evolved to include email reports and access to content via a web-portal or smart phone. The paper reports provide feedback on energy use and leverage social norms by comparing a household's energy use to their neighbor. Programs with web-portals are designed to engage customers further by leveraging multiple motivational techniques, such as goal setting, and uses data analytics to provide more targeted feedback on usage. We propose a presentation that will examine the impact of this evolution in program design on customer engagement, customer satisfaction, and energy savings. Leveraging our broad experience evaluating HER programs, we will present results of a meta-review identifying trends and exploring the effectiveness of the multi-channel, multi-touch, multi-motivational approach. Attendees would come away from this presentation with a deeper understanding of how differences in HER program design impacts program performance and ultimately energy savings. In addition, we will present the next generation of HER programs designed to move customers further along the home energy management continuum by leveraging evolving technologies (such as thermostats) and AMI.

1F: Next Generation Home Energy Reports vs Other Interventions

Moderator: Kate Scott, Energy Trust of Oregon

Speaker: Shawn Bodmann, DNV GL

What Lies Beneath: The relationship between savings and customer engagement with behavioral program feedback mechanisms

Comparative home energy reports (HERs), such as those provided by OPower, represent indirect feedback mechanisms aimed at customers to encourage them to reduce their energy consumption using the motivational power of social norms. These programs are gaining popularity. Ongoing changes in the marketplace and regulatory regimes, and the savings delivered by these programs, have resulted in the inclusion of this flavor of behavioral program in the energy efficiency portfolio of over half of the largest 50 utilities in the United States. Many of these programs are implemented as randomized control trials (RCT) which facilitate a clear path to attribution for any savings realized under the program. Evaluations of such programs have fairly consistently indicated 1%-3% annual electric savings, and 0.5%-1.5% annual gas savings for participants/treatments relative to controls. An inability to pinpoint precise behaviors and equipment changes that produce the savings is a question that continues to vex implementers and evaluators alike. The preponderance of the evidence from several evaluations that have attempted to identify specific behaviors and equipment changes suggests that the savings come from a variety of behavior changes (e.g.: turning off electronics overnight) or low cost/low impact equipment changes (e.g.: switching out incandescents for energy efficient lamps such as CFLs). The authors conducted an evaluation in upstate New York that included an extensive phone survey with questions on equipment purchase, usage, and maintenance behaviors to add texture to a billing analysis. Core evaluation findings were similar to those above, and an additional level of insight was gained by combining respondents' self-reported depth of engagement with the reports with savings estimates to investigate several questions related to Psychological mechanisms at play: - Does greater engagement with the reports lead to greater savings? Or, to what extent is simply receiving a report enough to produce savings? - Is there evidence of other mechanisms, such as Mastery Goals (which reference one's own past results rather than those of neighbors)? A better understanding (or confirmation) of the Psychological mechanisms activated by the HERs has implications for future implementation and research. For example: existence of a large segment of customers that realize savings, indicate simply receiving the HERs, and do not report higher levels of engagement, suggests a Hawthorne or Placebo effect and could lead to the adoption of cheaper reports that promise to deliver the same level of savings possibly without the same level of underlying analytics. On the other hand, if depth of engagement has a positive relationship with savings, interested parties could work on ways to draw customers into paying more attention to the reports. Finally, if Mastery Goals are also at play, it suggests that the rich field of Psychological research on Achievement Goals could be tapped for theoretical and practical ideas and suggests a new avenue through which to motivate energy saving behaviors.

1F: Next Generation Home Energy Reports vs Other Interventions

Moderator: Kate Scott, Energy Trust of Oregon

Speaker: Cynthia M. Trottier, Public Service of New Hampshire

Broccoli or Ice Cream? What Drives Energy Savings?

Public Service of New Hampshire (PSNH), a wholly-owned subsidiary of Northeast Utilities, is New Hampshire's largest electric utility with 1,500 employees, serving 500,000 homes and businesses. In February 2014, PSNH officially launched its unique Home Energy Reports pilot program. While PSNH has partnered with Opower to design, prepare and deliver the information-based Home Energy Reports, PSNH's program is unique in its design compared to Opower's traditional platform, and is the first Home Energy Reports program implemented in NH. A typical Home Energy Report program utilizes the normative format where a residential customer's energy usage is compared to the usage of similar neighbors to encourage changes in energy usage. For the PSNH program, 25,000 residential customers were randomly selected for the 12-month pilot, assigning half to a normative messaging track and the other half to a rewards messaging track. Rewards customers earn rewards based on energy savings they achieve by comparing their energy consumption with the same month from the previous year. As part of PSNH's program, variations of the report will be used to understand what approach will generate the most useful information and greatest potential savings for customers. Both sets of customers will also have access to an interactive web portal designed to help them actively engage with their energy information. They can use the portal to review additional efficiency tips, conduct an automated 30-second home energy audit, and develop a savings plan. Because this is the first Home Energy Report program to run normative and rewards messaging tracks at the same time, the utility industry, Opower, similar vendors, and interested parties are closely watching the results. The program will have been in place for nine months at the time of the Behavior, Energy and Climate Conference, and PSNH will have results that will answer such questions as: 1. Which set of customers saved more energy—normative or rewards? 2. Did customers of each track save more or less compared to participants of similar Home Energy Reports in the Northeast? The rest of the country? 3. Are there certain demographics that draw customers to a particular messaging track? 4. Which approach draws more customers to the interactive web portal? 5. Was there a difference in customer program satisfaction between normative and rewards customers? The results of PSNH's Home Energy Reports pilot program could change the future direction of similar programs. It could confirm that the normative messaging is indeed the best way to motivate customers to save energy, it could set the stage that rewards may be worth further investigation, or it could signal moving into a combined format of normative and rewards to maximize energy savings among residential customers.

1F: Next Generation Home Energy Reports vs Other Interventions

Moderator: Kate Scott, Energy Trust of Oregon

Speaker: Patrice Ignelzi, Applied Energy Group

Are You Like Me? Challenges in Developing Comparison Groups for Information Feedback Programs

OBJECTIVE: This paper aims to help program staff responsible for development and implementation of behavior programs identify and address the issue of comparative usage information. This paper will discuss how to make customer comparisons comprehensible and believable to program participants while at the same time enabling hoped-for savings and rigorous ex-post evaluation of those savings. RESULTS: Perhaps the most well-known and frequently implemented type of behavior-based energy efficiency program is the "comparative feedback" model, where customers receive reports on how their energy use compares with other, supposedly similar, customers. Who are these allegedly similar customers and how are they selected? In this paper and presentation, we will discuss our recently developed and applied approach to crafting customer groups that are truly comparable, for a new program launching in 2014. While customer selection that meets the exacting requirements of experimental design has been a popular topic for development of comparative usage feedback programs, exactly how the comparative usage information is created has not been as widely discussed. Who are the customers to whom the individual program participants' energy usage is compared? Creating truly comparable customer comparison groups has received little public attention, although this is critical to the program design and implementation. Effects range from the comparison values in the reports and customers' acceptance of the program (understanding of and belief in the fairness of the comparison and their decision to stay in or opt-out) to the effect this has on the participants' willingness to adjust their energy usage in response to the information. We developed an approach in which we created a set of comparison groups or cohorts, each with characteristics similar to customers targeted for participation in an opt-out comparative feedback program. We will describe how we designed the cohorts and issues we had to address, including: • Identifying and screening which data fields are routinely and reliably available in the utility customer database for characterizing customers • Prioritizing the characteristics to create the most accurate match among customers; e.g., is a pool more or less important than home vintage? • How finely the characteristics should match the participants (treatment customers) • Balancing the comparison group size for the target population • Once comparison groups are created, maintaining the integrity and stability of the cohorts over time We will also discuss the benefits of using this hierarchical cohort approach over others, such as propensity scoring and show how we applied it to support a program designed to treat 100,000 customers in 2014. WHY ACCEPT THIS ABSTRACT: At utilities all across the country, comparative feedback programs are a key focus of attention this year. This paper will present new work conducted for a new comparative feedback program launching in Spring 2014. The work is fully completed, has never been presented before, and has immediate applicability for staff planning to implement or needing to improve customer acceptance of comparative feedback programs.

1F: Next Generation Home Energy Reports vs Other Interventions

Moderator: Kate Scott, Energy Trust of Oregon

Speaker: Ali Bozorgi, ICF International

Most Critical Factors Impacting Cost-Effectiveness of Feedback Programs – A Sensitivity Analysis Using Recent Field Data

Feedback/behavior-based programs have been recognized as a mechanism to provide deeper energy savings and higher customer satisfaction. However, due to the limitations of robust ex post program evaluation data, there are significant uncertainties associated with the performance of these emerging programs, particularly, their cost-effectiveness as there is very little program cost data available. We will present the results of our recent study on the impacts and cost-effectiveness of two types of feedback programs, Home Energy Reports and Real-Time Feedback. while explicitly considering uncertainties. Using recent field data and a field-proven DSM analytics tool plus Monte Carlo simulations, we first analyzed the potential impacts of five feedback types on increasing a typical DSM portfolio savings. Second, a detailed cost-effectiveness analysis was conducted using four standard screening tests (TRC, PAC, RIM, and PCT). Third, the top three most critical factors impacting cost-effectiveness test results were identified. Finally, a sensitivity analysis was conducted on the factors with highest impacts including annual savings per household, useful life, administrative costs, incentive levels, and avoided costs. In our core analysis, TRC and PAC results suggest that both Enhanced Billing and Real-Time Feedback programs can be cost-effective on average. In our sensitivity analysis, annual savings per household shows the highest impact in TRC, PAC and PCT tests. Useful Life has second highest impact for the Real-Time Feedback program in all four tests, followed by participant cost and incentives. Avoided cost/kWh is the second most critical factor for TRC and PAC tests for the Enhanced Billing program, followed by admin cost – variable per participant (costs of generating reports, mails, etc.). Retail Rates/kWh is among the top three factors only for the RIM test for the Enhanced Billing program. This presentation gives program planners and administrators a robust and holistic way to view both potential savings and cost-effectiveness of feedback programs. It supports more informed decisions when integrating this program type into current and emerging DSM portfolios.

2A: Lightning: Marketing & Communication

Moderator: Joey Barr, Zerofootprint

Speaker: Jennifer Lynes, University of Waterloo

All At Once: Taking Jack Johnson's CBSM Campaign to the Next Level

Picture the following: no bottled water on site, local food for employees, biodiesel transportation, promotion of carpooling, annual impact reports, carbon offsets for energy use, partnerships with local NGOs and a social marketing campaign to promote local food and discourage single use plastic. This is the list of environmental initiatives of internationally–renowned musician Jack Johnson when he heads out on a world tour. Johnson's notoriety as both a musician and environmental activist gives him the potential to reach millions of fans. While many supporters of Johnson's work feel a strong connection to the environmental themes of his lyrics, it is his social action network, All At Once that has gained him recognition as the 'greenest musician'. Inspired by Canadian psychologist Doug McKenzie-Mohr's community-based social marketing (CBSM) workshop, Johnson's partner, Kim, began designing the All at Once campaign in 2007. Since the 2008 world tour Sleep through the Static, Johnson and his team have been promoting All At Once to provide tools, resources and incentives to motivate fans to take individual environmental action and become involved with local non-profits doing hands-on work in their communities. In 2013, a team of researchers at the University of Waterloo joined efforts with Jack Johnson to assess and further develop the All At Once campaign. In the first phase of this research, a retrospective study of Johnson's 2008 and 2010 world tours was conducted to see which components of McKenzie-Mohr's five CBSM steps had been applied in the design and implementation of the campaign. Information was gathered from Johnson's extensive outreach promoting All At Once initiatives including reports, videos as well as interviews and in-person meetings with the Jack Johnson team. Results showed that components of the CBSM model that were particularly well integrated into the campaign were the use of commitments, incentives, norms and social diffusion, as well as a final evaluation of the full-scale implementation of the campaign. Areas that were lacking included initial barrier and benefit research for the selected behaviors as well as more defined research on a specific target audience among Johnson's fans. The focus of this presentation will be on the second phase of the research, presenting an analysis of data collected data on Johnson's summer 2014 world tour. This data includes observation of All At Once initiatives at Johnson's concerts both in U.S. and Canada. Surveys will be conducted onsite with fans to establish a list of barriers and benefits related to the behaviors that have been selected as a focus of the campaign: local food and single use plastic. Results will provide insight as to how Johnson's current social marketing initiatives could be enhanced to directly address barriers and benefits of the target audience and develop effective strategies for encouraging behavior change. The research also demonstrates how social marketing models such as CBSM can be applied by celebrities to foster sustainable behavior.

2A: Lightning: Marketing & Communication

Moderator: Joey Barr, Zerofootprint

Speaker: Jeremy Scharfenberg, Columbia Association

Being a Community Messenger for Energy Efficiency and Climate Change

The Columbia Association (CA) is a nonprofit homeowners association (HOA) dedicated to providing the highest level of service and amenities to the 100,000 residents of Columbia, Maryland. As an ENERGY STAR® Partner, CA is conducting robust outreach to residents and business that are members of the Association, individuals who regularly use our facilities, and the greater Columbia community. CA is striving to serve in a "trusted messenger" role to encourage energy efficiency and climate awareness, including participation in all ENERGY STAR® and associated Baltimore Gas and Electric (BGE) sponsored incentive programs. CA's approach to promoting energy efficiency and climate change mitigation was multifaceted. Primary promotional activities included: 1) supporting the Change the World, Start with ENERGY STAR campaign; 2) promotion of ENERGY STAR products and programs and BGE programs through print and electronic media; and 3) significant advocacy of the Home Performance with ENERGY STAR Program (HPwES) that included an outreach video and teaming with a community engagement partner to implement a Columbia Home Energy Efficiency Upgrade Cooperative. CA is actively promoting the Change the World, Start with ENERGY STAR (CTW) campaign throughout the community. The kick-off of the initiative was planned to coincide with Earth Day and promotional flyers and signage were placed in all of our more than 60 facilities. As part of a community sustainability festival, CA reserved and staffed a table promoting energy efficiency and the CTW Campaign. CA coordinated with the BGE Smart Energy Savers program staff to develop a synergistic relationship to promote energy efficiency in the community leveraging ENERGY STAR products and programs. CA developed a regular series of stories to promote ENERGY STAR and BGE sponsored programs in the community that were published in multiple media formats throughout the year. In many cases CA worked directly with BGE staff to ensure that appropriate content was utilized and to align timing of promotional messaging for specific programs (e.g., ENERGY STAR appliance rebates being promoted in the same month by BGE and CA). Efforts were made to augment each story with specific examples of what CA is doing with regards to energy efficiency in its own facilities to show leadership in the community in this area and provide greater weight to be promotion of energy efficiency and climate awareness In addition to multiple communications pieces on the HPwES program implemented by BGE, CA has taken several significant steps to engage the community and increase participation in the HPwES program. CA's active community engagement efforts include: Collaboration with BGE staff to develop and promote a HPwES promotional video at a CA home that includes testimonials from the homeowner and a demonstration of the HPwES audit; and engaging a local non-profit organization to actively engage the community to promote participation in the HPwES program by serving as an energy advocate and leveraging pre-approved energy services contractors to conduct the HPwES audit and implement recommended measures.

2A: Lightning: Marketing & Communication

Moderator: Joey Barr, Zerofootprint

Speaker: Catharine Lo, Blue Planet Foundation

Stuff your utility company doesn't say: Smart grid social marketing by an independent community advocate

In March 2014, the Hawaiian Electric Company (HECO) announced the initial phase of their smart meter rollout, targeting 5,200 customers in four communities on Oahu. The four communities were chosen for their diverse physical terrain and customer profiles. HECO will use this initial phase to evaluate strategies and technologies that may be implemented with the anticipated full deployment of smart meters in Hawaiian Electric service areas by 2018. Blue Planet Foundation, a nonprofit clean energy advocate based in Honolulu, partnered with HECO to support their initial rollout, since grid modernization is aligned with Blue Planet's mission to clear the path for clean energy. As highlighted among the best practices for customer engagement in smart meter deployment evaluations throughout the country, consumer trust is a key element of success. Blue Planet's positive brand recognition and identity as a credible third party advocate provided transparent, informed, and meaningful outreach that helped secure customer buy-in. Blue Planet insisted on maintaining an independent voice in our messaging and materials. The three-month-long community engagement effort included three components that supplemented HECO's customer engagement plan: 1. DOOR-TO-DOOR CANVASSING: Teams of Blue Planet canvassers visited customers' homes to talk about the upcoming smart meter installations. Canvassers left materials from Blue Planet and HECO that explained—in very different styles—why customers benefit from the meter upgrade. We also distributed 12-month planners with reminders prompting customers to monitor their energy usage online. 2. COFFEE HOURS: We participated in informational "open houses" planned by HECO in each target community. Concerned residents with were able to ask questions face-to-face with utility employees, Blue Planet staff, and other community advocates. The coffee hours provided an opportunity to identify issues that may arise in the larger rollout. 3. SOCIAL MARKETING CAMPAIGN We launched a "Modern Grid" campaign to elevate awareness about smart meter benefits, while being honest and informative about perceived risks. We also made a point to maintain a community voice distinct in tone and style from the utility's. Highlights of the marketing campaign: • Messaging using customer-friendly language and illustrations that were not technical or "corporate" • Webpage with resources and links from reliable sources • Smart meter education packet designed for Moms in Hawaii, a Blue Planet community partner •Social media engagement to share news and facilitate discussion • A cartoon animation "Miso Smart Makes a Speedy Delivery" using "The Blue Planeteers" superheroes to demonstrate how smart grid functions • Commentary pieces for media outlets to shape public dialogue • Monitoring of public perceptions and opposition efforts • Identifying modern grid "ambassadors" to share success stories (lower bills, increased energy awareness, benefits of real-time feedback) through video testimonials Smart meter installation for the initial phase continues through May 2014. So far, the campaign has been tremendously successful with less than 20 deferral requests. (On Kauai, under the Kauai Island Utility Cooperative, almost 10 percent of customers opted out.) Blue Planet will continue to work with HECO to maximize customer acceptance.

2A: Lightning: Marketing & Communication

Moderator: Joey Barr, Zerofootprint

Speaker: Lindsay Matthews, University of Waterloo

Under Cover: A Myster Shopping Study on the Role of Retailers

Consumers assert they have trouble choosing sustainable products because of confusion at the point of purchase. In addition to offering more sustainable products in stores, retailers can use marketing mix strategies to make consumers aware of these products and influence the buying decision. For instance, when a customer walks into a store to purchase an appliance such as a refrigerator, how does that store promote (or not) the sale of energy efficient appliances? Few studies have evaluated the current marketing mix strategies being used at the store level or whether these strategies address the barriers to purchasing sustainable products that have been identified by consumers. This research sought to construct empirical evidence related to in-store contextual factors that promote buying decisions towards sustainable products, with a particular emphasis on energy and water efficient products. Specifically, washing machines and televisions were the focus of this study. Between October and November 2011, four mystery shoppers went into 38 retail stores in Southern Ontario, Canada to observe: 1) the presence of green messaging, 2) how (and if) retailers use various promotional practices to showcase environmental performance, and 3) how (and if) sales associates present information about the environmental features of the products they are selling. The mystery shopping exercise demonstrated that little or no green messaging was encountered. Of the 152 shopping experiences undertaken by the mystery shoppers, 66% encountered little or no green messaging, while 20% encountered some messaging and the remaining 14% encountered much or a great deal of green messaging. The most common environmental claim observed was the ENERGY STAR label. Mystery shoppers reported on average, that the ENERGY STAR symbol was clearly visible among 73% of all washing machines on display and on 53% of all televisions on display. Sales associates did not generally discuss ENERGY STAR in their product presentation until the shoppers reveal they are interested in saving energy (and water). This despite the fact that ENERGY STAR is the most commonly displayed environmental messaging type for both televisions and washing machines. This study's observations indicate that more training needs to be done to help shift sales associates attitudes and increase knowledge in support of ENERGY STAR, energy efficiency and water efficiency when selling televisions and washing machines. Sales associates were limited in their abilities to find and then compare products based on energy and water efficiency and this can hinder a consumer's ability to find the most energy and water efficient product to meet his/her needs. The future expansion of the ENERGY STAR Most Efficient label into products sold in Canada as well as the expansion of the EnerGuide label for televisions will create additional opportunities for sales associates to more effectively help consumer identify and compare energy and water efficient products. Based on the results of this study our research team is currently implementing an in-store intervention with the sales associates and then re-deploying the mystery shoppers once the intervention has been implemented to assess its effectiveness.

2A: Lightning: Marketing & Communication

Moderator: Joey Barr, Zerofootprint

Speaker: Carie Cunningham, Michigan State University

High Contrast in Low-Level Vision as It Relates to Weather Communication

High Contrast in Low-Level Vision as It Relates to Weather Communication Abstract Intuitively, many people believe they are aware of all the information available in their visual field. However, that may not be correct. This paper identifies key visual features that make up the critical weather information being shared via television broadcasts. As climate change continues reshape the day to day meteorological landscape it is important to identify more effective ways of communicating weather events. Specifically, this project uses a cognitive science approach to look at the competing hypotheses about the role of motion in attentional capture. Attentional capture is the first step to message processing and thus gaining a person's attention through the use of graphics can help meteorologists explain weather phenomenon better. The attention literature suggests that attention will switch from one stimulus to another when the second stimulus is either new to the environment or "odd" to the environment. This paper reports on a critical test between three competing hypotheses (new object, unique event, and behavioral urgency) to better understand how to capture attention in a realistic television viewing setting. Using a within subjects design, 44 participants viewed a video and then were asked if they recognized any of the secondary stimuli manipulations in the three conditions. The stimulus video was a segment of an ABC News national meteorological broadcast on extreme storms. The secondary stimuli were two black and white weather graphics. These graphics were inserted in the lower corners of the video screen, as is commonly found with television program graphics. The graphics were presented in one of three ways consistent with the hypotheses: onset, looming, or jittering. Using a binomial hypothesis test, results of the survey showed that about 70 percent of participants did not see any graphics. Of those who did see the graphics, the new object hypothesis was supported, while the other hypotheses were not. The results of this study failed to replicate some experimental findings in real world conditions. There are a number of potential explanations for this; most directly that bench cognitive science findings for visual attention do not easily translate to real world mass communication experiences. This conclusion signals caution to media designers who assume that bench findings readily transfer to media production choices. This is supported by the finding that sixteen viewers, a better than chance amount, incorrectly indicated that they viewed the stimuli in the upper-right-hand corner of the screen. There seems to be a bias for screen corners and the center. These locations also happen to be popular places for reporting information on national and local networks. This seems to point out general bias and not actual icon recognition or message processing. This evidence, along with the failed recognition of many participants, gives cause for further research into communicating severe weather events and alerts. As climate change events become more frequent, it is important to draw from the neural processing of messages in order to effectively communicate the danger to the public. Keywords: cognitive, communication, inattentional blindness, motion, attentional capture

2A: Lightning: Marketing & Communication

Moderator: Joey Barr, Zerofootprint

Speaker: Linda Silverman, US Department of Energy

Energy Literacy: Improving Energy Decisionmaking through Improved Knowledge

Most Americans have little knowledge of where their energy comes from or about how our energy system works. Traditional energy education has been narrowly taught, if at all, through the technological and scientific perspective. To address this, the Department of Energy (DOE) led the development of "Energy Literacy: Essential Principles and Fundamental Concepts for Energy Education" (Energy Literacy Framework), which provides a multidisciplinary approach to teaching about energy – from the natural and physical sciences to the social sciences. The Energy Literacy Framework, which was developed and endorsed by 13 Federal agencies, education and energy experts, can be applied to any age group, and is being used by instructional/educational content designers, summer camp developers, media creators, non-profits and others to teach about energy. DOE is developing tools and videos to aid users and educators to facilitate its use. DOE will present its hybrid approach and metrics to capture how videos, webinars, workshops and trainings are aiding the call to teach energy in a more holistic manner that leads to energy behavior change. Bittle, S., Rochkind, J., & Ott, A. (2009). The energy learning curve. Public agenda. As cited in DeWaters & Powers, 2011, page 1699.

2A: Lightning: Marketing & Communication

Moderator: Joey Barr, Zerofootprint

Speaker: Katherine V. Randazzo, Opinion Dynamics

Motivations, Messaging, and Constraints for Deep Savings

How can programs start to go beyond the "easy" to get to deeper savings? With much of the savings from low-hanging fruit gone, there is a need for deeper retrofits and better targeting to help programs find savings. Our research tapped into customer motivations to help PG&E's Whole House program achieve deeper savings. Through our presentation, we will explain the behavioral stage model that we used to understand customer "readiness to make a change". The model depicts where people are in their decision-making and how to unlock energy savings. Inputs to the model included a general population survey of homeowners, as well as interviews with participants in, and drop-outs of, a deep-savings program. In our description of the model, we will demonstrate how it is a flexible model that can be used for other domains as deemed important for a program or market. Our presentation will then describe how we used this behavioral stage model to identify customers to target. We will discuss how the model constructs distinguish between various groups of homeowners in the general population; or more specifically, how we were able to categorize these homeowners into one of three levels of intent to perform home energy upgrades: no intent, limited intent, and full intent. Based on our analysis of these groups, we will explain what creates the gap between intent and behavior change (energy upgrade), and what we can do to "bridge the gap." Our model reveals some important attitudes and characteristics that explain who inquired about the program but didn't continue, and who took a second step, but didn't complete. We will draw on these research findings to suggest how such customers might be encouraged to bridge this gap. Finally, we will show how the model and other variables help predict who saves and who doesn't after participating in PG&E's home upgrade program. Ultimately, our research for PG&E showed that messaging that relies on a combination of altruistic (e.g., environment) and self-interest (e.g., energy bill savings or comfort) is stronger than motives in any one domain alone. Our research thoroughly explored three key domains: (1) Environment, (2) Comfort, and (3) Finance. In this presentation, we will show which motivations are the most important, how motivations vary by group, and what the largest constraints are for achieving deep energy savings.

2A: Lightning: Marketing & Communication

Moderator: Joey Barr, Zerofootprint

Speaker: Kim Johnston, WECC

Sports Marketing: A Viable Option for Utilities

"Play ball" are the words heard as sports marketing sounds off for the season—the act of using a partnership with a sports organization as a vehicle to sell goods and services, promote a brand, and prompt behavioral change. This type of marketing and outreach is less about executing a single tactic and more about using a sporting event or team to increase awareness. Opportunities are not limited to professional sports—they also include minor league sports, college athletics, and alternative sports. Sports marketing can take many different forms, including: season sponsors, game day or season-long advertising, event sponsorships, specialty sponsors. Each of these, whether used individually or as a package, provides options to distribute your message. An added benefit, when used appropriately, is that you have the opportunity to deliver a tailored message to a captive audience. WECC has used sports marketing as part of outreach efforts for a number of clients—including it as part of umbrella marketing campaigns, sports sponsorships, and at game day giveaways. Linking sports and marketing is not a new phenomenon, but ways WECC has helped clients build on the relationship between sports teams, consumers, and utility energy savings programs are. WECC has found that using sports marketing with selected teams is an effective way to reach different audiences—and there is no greater medium to reach large groups of consumers and provide hands-on education. During our session, we will explain how sports marketing is an effective tool to achieve energy savings, educate end use customers, and reach a variety of target markets through our society's love of athletics. We will cover the steps of working with a sports organization, specifying your campaign goal, honing in on your target audience(s), and most importantly, your message—which should be strong and consistent. We will showcase our experience partnering with professional baseball, hockey, soccer, and basketball teams to promote the importance of energy efficiency and in distributing energy-saving products while raising the client's public relations profile. Ways we've done so include: hosting educational/sponsor tents at the entrance or exit of the venue, distributing program materials, engaging children (and kids at heart) in interactive games, and utilizing pregame promotions, social media, and the team websites—all while conveying the utility's message. In/at-game promotions have included: promotional signage, video announcements, public announcements, bulb giveaways, and sponsored half-time events. Whether you are looking for additional energy savings, the ability to reach a certain audience, or provide additional energy efficiency education to your customers, this presentation will guide you through the process of effectively using sports marketing as an outreach vehicle. Session attendees will also learn about how to reach different target markets by incorporating sports into their marketing mix and innovative ways we run ballpark events.

2A: Lightning: Marketing & Communication

Moderator: Joey Barr, Zerofootprint

Speaker: Joanna Perez-Green, Community Energy Services

Diversified Marketing for Commercial Third Party Programs

For over a decade, the SmartLights Program has been successful in encouraging small and medium size businesses to perform energy efficiency upgrades to their lighting and refrigeration equipment. However, after 10 years, the messaging around energy efficiency must adapt to address different motivations and reservations. With late adopters, newcomers and the influx of more efficient technology, commercial customers must know that energy efficiency doesn't have a targeted end goal. Furthermore, understanding the different drivers in the customer uptake of third party energy efficiency programs is key to continued adoption of energy efficiency in the commercial market. Recent evaluations of the diversified marketing strategies implemented by SmartLights revealed a range of impact on customers based on customer type. These evaluations were based off of the marketing strategy below. SmartLights primarily markets through two channels; local outreach campaigns, and referrals from partner organizations. The outreach campaigns consist of door-to-door outreach with Program staff and a 'Trusted Messenger' for Program credibility. The Trusted Messenger can be utility, city or county staff, or a community member. This messenger impacts the outreach efficacy with regard to education, audits and installations. The referrals from partners include local contractors, utility account managers and green business programs. These partners provide different approaches to energy efficiency and have different customers. In reviewing the outcomes of the various marketing strategies, the business and the marketing source created a range of impacts on the customer education and program implementation. This presentation will review data from the SmartLights Program on which marketing strategies yielded the best results. We will focus on data driven, realized results such as audits, installations, and kWh savings for different business types. There is a strong case to be made for education and social norm transformation, that can be supported by market saturation in corresponding local areas. Additionally, the presentation will summarize best practices on how these marketing strategies can be translated to other business sectors and communities.

2A: Lightning: Marketing & Communication

Moderator: Joey Barr, Zerofootprint

Speaker: Kevin Duffy, ICF International

Blending Boots & Technology: Changing Behavior through Community-Based Outreach and Smart Meter Technology

Barriers in changing energy behavior include a perception that changes are insignificant, and energy saving behaviors can be forgotten without consistent engagement and reminders, which minimizes persistent energy savings. One way to address these barriers is to provide energy use data directly to the customer so they can gain a better understanding of how they use energy. Utilities can use smart meter technology to engage their customers and continue to remind customers through community-based social marketing and web-based activities. This presentation will provide insight into how one major Midwest utility is empowering customers with smart meter data and discovering savings through behavior change. After a smart meter is installed, a conversation begins between the utility and their customers. This program, uniquely branded as the Smart Energy Challenge (SEC), is a "boots-on-the-ground" outreach initiative designed to promote energy efficiency and the utility's Smart Energy Program. Customers will be encouraged to participate in the SEC through community-based social marketing techniques and strategies as well as web-based gamification and calls-to-action. The objective is to gauge the use of a web-based loyalty program and a coordinated community challenge competition among local organizations in Grand Rapids, MI. The program garners participation among community members while providing energy efficiency information, driving energy efficiency program participation and engaging them in the Smart Energy portal (Opower) so they can better control their energy use. The SEC tests the virality created by social marketing techniques, the impact of local organizations, effectiveness of loyalty credits and loyalty store prize redemption, grassroots impacts, gamification, persistence, and cost effectiveness.

2B: Activism & Culture Change

Moderator: Susan Mazur-Stommen, Indicia Consulting

Speaker: Kathryn Doherty, Antioch University New England

From Alarm to Action: Narrowing the Belief-Behavior Gap Regarding Climate Change

According to the Intergovernmental Panel on Climate Change (IPCC), human behavior is one of the least understood components of the climate system. This study contributes to our comprehension of human conduct by offering an improved value-belief-norm (VBN) model for behavior in the context of climate change, and providing a greater understanding of the precursors to public mitigation action. Our ability to mitigate the worst consequences of climate change hinges on widespread public engagement and behavior change at all levels of society. Although personal conservation behavior is important to alleviate climate change, the implementation of U.S. climate policies will be essential to reach large reduction targets such as those recommended by the IPCC. However, research suggests that the political will to adopt such policies is unlikely to exist without increased public demand. Therefore, citizens' public mitigation actions (e.g., contacting elected officials, supporting organizations working to curb climate change, voting, signing petitions) are critical for legislative response that could mitigate the most debilitating consequences of anthropogenic climate change. It may be tempting to assume that individuals who are most concerned about climate change (the "Alarmed" segment) engage in public mitigation actions, but research suggests that while some Alarmed do take public action to reduce climate change, many do not. It is not entirely clear why. Decades of research on various forms of efficacy and descriptive social norms suggest that these factors are important catalysts for action, yet little is known about the influence of these variables on public action to reduce climate change. These issues give rise to a number of questions that guided the present study. These questions include: What leads to public engagement regarding climate change? What drives those who are most concerned about climate change to engage in public mitigation action? How well does the VBN explain Alarmed individual's public mitigation action? How and to what extent do efficacy variables and descriptive social norms influence the Alarmed's public actions to reduce climate change? What can we learn from Alarmed individuals who are taking public mitigation action, and those who are not, that might illuminate reasons for engagement? The value belief norm theory has successfully explained human responses to many environmental issues such as reduced car use and personal energy conservation, but it has not been used specifically in an attempt to understand and explain what drives public action to alleviate climate change. Additionally, the VBN may still have room for improvement such as addition of more predictor variables. This study compared the VBN's ability to explain Alarmed individuals' public mitigation action to an author-created model that added four efficacy variables and descriptive social norms to a modified VBN model. Data were collected through an electronic survey of 702 Alarmed Vermont residents, and were analyzed using structural equation modeling. In this presentation, I will share the major findings of this research study and discuss the implications of them.

2B: Activism & Culture Change

Moderator: Susan Mazur-Stommen, Indicia Consulting

Speaker: Lynne Cherry, Young Voices on Climate Change

Youth as Catalysts for Change

Youth can spark a public outcry for leaders to transcend politics, reduce CO2 and lead the change to a sustainable future. Building on research on self-efficacy, negative messaging and "motivated avoidance", Young Voices on Climate Change (YVCC) has carved a distinctive niche in the field of climate change education and activism. Our centerpiece project, the Young Voices for the Planet (YVFP) films, take a fundamentally different approach than other climate education efforts by documenting and communicating the role youth ages 9-19 are playing in helping solve the climate crisis, finding creative win-win solutions, reducing the carbon footprint of their homes, schools and communities, and engaging administrators, government, parents and community. Many scientists and educators noticed, and Anthony Leiserowitz's research at Yale confirmed, that negative messaging frequently overwhelmed and alarmed people, causing them to become resistant rather than motivated to take action. A study in the Journal of Personality and Social Psychology shows that people, when faced with a troubling and complicated issue that they know very little about, are motivated to avoid learning more about it, wrapping themselves in denial. Motivated avoidance causes people to turn off. It explains the psychological reasons why, when we tell people about gloomy climate science, they may run to the deniers and why we must take into account the psychological effect the disturbing truth may have. Rather than focusing on the negative impacts of global warming, the YVFP films use the power of positive visual storytelling to inspire people to engage and act. The films' diversity ensures that every young viewer will see others like themselves to whom they can relate-- their peers making a difference. Both youth and adults, after watching the success stories often think, "If they can do that, so can I." For example, after watching the films, 9-year-old Alice Van Evera started a club called "Save Tomorrow," which overturned a ban prohibiting solar panels on town buildings. Other young people have encouraged their parents to reduce their CO2 emissions-- thereby reducing their electric bills-- at home and work. One girl's father traded out air-conditioners in office buildings he owned for energy-star appliances, saving thousands of dollars. The logic in taking a positive approach is gaining currency among educators, scientists, non-profit organizations, government agencies, and institutions that had, in the past, unwittingly focused on tactics that alarmed and discouraged people. Numerous groups such as Alliance to Save Energy, Jane Goodall's Roots & Shoots, Interfaith Power and Light, and government agencies including NASA, NOAA and the U.S. Forest Service, have linked to YVCC's films. The movies have been screened in science museums, the UN, COP15 in Copenhagen, and at hundreds of film festivals, educational and scientific conferences, theatres and other venues. The film series and companion teacher guide, Empowering Young Voices for the Planet, make climate change relevant, engage new constituencies on a broad scale, build leadership among youth and adults, help grass-roots activists and volunteers communicate about climate change, and provide tools and information to ultimately change policy on global warming.

2B: Activism & Culture Change

Moderator: Susan Mazur-Stommen, Indicia Consulting

Speaker: Rachelle Macur, Group14 Engineering

Creating a Culture of Sustainability: A Process Approach to Resident Engagement

The way people behave, particularly their habits, have an immense effect on our social and environmental relations. When focusing on sustainability initiatives (such as energy, water, waste reduction, and healthy living) this couldn't hold more true. For developers and property managers of affordable housing communities, these behaviors can translate into dollars and cents; but it can also translate into to improved community relations, reduced work orders for maintenance staff, and overall satisfaction for both staff and residents. The challenge is in creating a lasting change that the housing communities can depend upon. Developers and property managers often utilize incentives and education to engage their residents and attempt to modify their behaviors. Unfortunately, these methods often fail to provide lasting change. So what is the key? Based on research and repeated positive results, we propose focusing on "how" the message is delivered versus focusing on the "what" the message is. A process approach focuses first on the how – how to understand a community's values, how to properly frame the resident engagement program and its goals, and how to comprehensively dissect targeted behaviors and barriers prior to implementing engagement strategies. In the field of resident engagement, process is the key element. Process, combined with a solid foundation, allows management to develop a value-driven and community specific engagement program. Through an understanding of what a community needs, and knowing how to speak to those needs, new and lasting habits can be formed. Rachelle Macur, Anthropologist and Sustainability Specialist at Group14 Engineering, will discuss this process approach and how it is being utilized in the current training program, "Best Practices in Resident Engagement." This in-depth training was developed on behalf of Enterprise Green Communities (EGC) in order to disseminate cutting-edge information and practices to affordable housing developers. It showcases techniques to work successfully with residents, uncovers barriers to sustainable behaviors, offers ways to implement engagement strategies, and suggests systems to measure and track progress. EGC has successfully delivered this training to several dozen affordable housing agencies throughout the nation with the goal of optimizing organizations' sustainability initiatives, enhancing resident satisfaction, and ultimately creating a culture of sustainability.

2C: Community-Scale Transportation Initiatives

Moderator: Jonathan Burbaum, ARPA-E

Speaker: Bernadette Suetterlin, ETH Zurich, Institute for Environmental Decisions (IED)

Judging Energy Consumption Based on the Symbolic Significance of Behaviors

The ability to adequately estimate the energy consumption related to a behavior is a prerequisite for showing effective energy-friendly behavior. However, people generally aim to arrive at a decision in the most efficient, time-saving way. They do not engage in an extensive processing of all available information, but rather rely on heuristics. That is, they base their judgments on easily accessible attributes, while neglecting other crucial attributes. Situations where a person must make value-laden decisions about topics that are particularly subject to social norms, such as energy friendliness, are part of everyday life. In these decision situations, attributes of strong symbolic significance, such as driving an energy-efficient car, are highly accessible and prevalent. We contend that people base their judgments on attributes of high symbolic significance (e.g., driving an energy-efficient car) in such situations, while largely ignoring symbolically neutral attributes (e.g., driving only a short distance per year). However, neglecting symbolically neutral information might impede judgment accuracy. Based on this reasoning, we postulate that people are subject to a certain judgment bias we call the symbolic significance fallacy when judging energy-related behaviors. In a series of studies on energy consumption estimations, we provided evidence for people's susceptibility to the symbolic significance fallacy. Participants were presented with two car-driver descriptions. One entailed a positive symbolically significant attribute (e.g., driving a Prius) and a negative symbolically neutral attribute (e.g., covering 28,700 km/y). The other description entailed a negative symbolically significant attribute (e.g., driving an SUV) and a positive symbolically neutral attribute (e.g., covering 11,400 km/y). Thereby, the driver with the positive symbolically significant attribute (i.e., the Prius driver) consumed more energy than did the driver with the negative symbolically significant attribute (i.e., the SUV driver). Supporting our assumptions, the findings showed that the energy consumption of the driver with the positive symbolically significant behavior (driving a Prius) and the negative symbolically neutral behavior (covering 28,700 km/y) was rated lower than the one of the car driver exhibiting the negative symbolically significant behavior (driving an SUV) and the positive symbolically neutral behavior (covering 11,400 km/y). This was also true when participants were presented with both descriptions simultaneously allowing a direct comparison. Supporting generalizability, this effect was shown for various other energy consumption domains, such as commuting, room heating, and meat consumption. As the findings demonstrated, the symbolic significance fallacy proved remarkably robust. The effect endured even when respondents were presented with detailed information on the car's fuel consumption that enabled an exact calculation of total energy consumption. The present research provides strong evidence for people's susceptibility to the symbolic significance fallacy and the potential misperceptions involved when judging energy-related behaviors. The findings give practical insights, pointing out misperceptions in the estimation of energy consumption that could impede the adoption of adequate energy-friendly behavior.

2C: Community-Scale Transportation Initiatives

Moderator: Jonathan Burbaum, ARPA-E

Speaker: Trudy Ledsham, University of Toronto

Increasing Cycling for Transportation through Behaviour Change Programmes

We will present the results of a summer 2014 cycling behaviour change research project and an in depth analysis of our 2013 interventions. There is significant latent demand for cycling in cities as evidenced by a recent City of Toronto Planning study "Living in Downtown and the Centres (2012) as well as by the Portland typologies work developed by Geller and tested by Dill and McNeil. Traditional cycling advocacy has focused on physical infrastructure as the key method of increasing cycling participation. However, increases in cycling behaviour can also be achieved through social infrastructure, community building and peer mentorship. In the absence of any particular change in cycling infrastructure, cycling trips in Toronto increased by 79% between 2006 and 2011 (DMG, 2014). Yet, studies that rigorously evaluate the independent effects of behaviour-based cycling promotion initiatives are exceedingly rare (Bird et al.,2012; Ogilvie et al., 2007; Pucher et al., 2010). In 2013, we completed and rigorously studied two behaviour change pilot projects. The first used the traditional tools of social marketing for behaviour change. It involved initial personal outreach through a free bike tune up workshop in the community to help segment the population into those interested in change- a key factor in successful behaviour change (Chatterjee et al., 2011; Christensen et al., 2012; Gatersleben & Appleton, 2007; Yang et al., 2010). The remainder of the program involved prompts, commitments/pledges and outreach via email and posters as recommended in the literature (Gatersleben & Appleton, 2007; Bowles et al., 2006; Rose & Marfut, 2007; Stokell, 2010; McKenzie-Mohr, 2000). We found increased awareness of cycling and changes in attitudes towards cycling, but no actual behaviour change. The second program involved the same basic social marketing tools, but also had a significant mentorship component. This program resulted in a 500% increase in trips by bicycle over the control group as well as extensive changes in attitudes towards cycling. The results document and emphasize the important role of behaviour modeling, social cues and community partnerships (De Geus et al., 2008; Titze et al., 2008; Cooper, 2007). Over the summer of 2014, we are researching an expanded cycling mentorship program with a stronger geographic focus in order to leverage the social infrastructure aspects of the mentorship program. Greater numbers of participants will create a more robust data set and determine if results are consistently reproducible. Additionally, we are examining mentor and mentee motivations in order to more fully understand how to segment and recruit mentor and mentee populations. From this research we will develop an adaptable and reproducible program with a suite of behaviour change tools for other organizations to adapt and adopt. In urban communities, active transportation and bicycle use in particular, is a linchpin solution at the centre of several intersecting spheres of urban life. Positive impacts include reductions in GHG emissions, increased air quality, reductions in traffic congestion and commuting times, improved revenues for local businesses and increased physical activity; all of which impact individual and public health as well as community well-being.

2C: Community-Scale Transportation Initiatives

Moderator: Jonathan Burbaum, ARPA-E

Speaker: Sandra Y Richter, MIT Media Lab

Persuasive Urban Mobility: The Need for Soft Transportation Policy Measures in Future cities

Persuasive Urban Mobility: Persuasive Urban Mobility: The Need for Soft Transportation Policy Measures in Future cities Sandra Y Richter1, Alexandra Millonig2, Maanika Keesara3, Katja J Bego4, Emma Haley5, Stefan Seer6, Ryan C C Chin7 1 Affiliation MIT Media Lab, USA 2 Affiliation Austrian Institute of Technology, AT 3 Affiliation Wellesley College, USA 4 Affiliation Wellesley College, USA 5 Affiliation Wellesley College, USA 6 Affiliation Austrian Institute of Technology, AT 7 Affiliation MIT Media Lab, USA Abstract Promoting active mobility of people is of paramount importance when it comes to tackling societal challenges such as health and quality of life and increasing sustainability in general. Therefore, much effort is taken in order to encourage people to use more sustainable forms of mobility and change from high energy modes to low energy modes. Common policy measures usually aim at either directly reduce car use, or incentivize alternatives like bike and public transportation use. In many cases 'hard' measures like cash-out schemes and congestion pricing are successfully applied; however, these policies tend to be prohibitively costly to implement for most cities with a high probability of failure when implemented without taking contextual information into account. Moreover, monetary incentives and disincentives may fail to trigger intrinsic motivation and many people merely react to the given constraints and will return to their previous habits if they can. There are, however, some approaches focusing on using 'soft' policies and persuasive strategies for encouraging people to permanently changing their behavior. As such strategies have already proved to be very successful in different fields, measures like non-monetary incentives, persuasion technologies or peer pressure seem to provide the potential to be more effective while at the same time requiring lower costs for the cities. Still, little is known about the effectiveness and applicability of persuasive theories in the mobility context and examples of soft policy measures are scarce. This contribution provides an international review of hard and soft policies which are currently applied for reducing car use in different cities. We developed a framework for evaluating the potential of commonly used policies. Starting from an in depth case study of Paris as an example for a forerunner city in mobility, we developed a matrix of different types of policies which are being implemented most frequently. This matrix provided the basic structure for reviewing further policies on the global scale. The identified measures have subsequently been compared, providing insight into the similarities and differences between systems on different levels (e.g. costs, social impact, or effectiveness). In this way, key characteristics of effective measures as well as significant knowledge gaps – particularly regarding the emerging approaches using persuasive technologies and social incentives – have been identified. The results show that hard policies are frequently used and show high effectiveness, but experiences on the long-term effects of policies are lacking. Especially soft policies, which are expected to achieve higher acceptance and higher effectiveness, are still insufficiently evaluated. The limited experiences and findings about the effectiveness of policies implementing persuasive technologies and non-monetary incentives demonstrate the importance of further research in this field. This study indicates potential approaches for developing, testing and evaluating persuasive strategies for soft policy measures, providing the basis for offering comprehensive information for cities selecting appropriate measures to stimulate permanent behavioral changes in mobility.

2D: Unlocking Behavior-Based Energy Savings in Commercial Buildings

Moderator: Dan Seligman, MEA

Speaker: Olga Gazman, Northwest Energy Efficiency Council

Unlocking Behavior-Based Energy Savings through Employer Engagement

The energy used inefficiently or unnecessarily in buildings is estimated to be as much as 30% with buildings accounting for 38% of the carbon dioxide emissions in the U.S. Reducing building energy use provides benefits to the environment while also lowering operating costs for the owner. The building operations professional plays an important role in this energy management and environmental strategy. As evidenced in literature, a successful energy management plan for a commercial building must be supported by executive management and carried out by a skilled building operations workforce. Building operations is a dynamic, evolving profession and the building operations professional is expected to keep pace. Informal and formal learning continues to be an important part of the operator's professional development. In a 2012 impact study, energy savings associated with energy efficiency related measures undertaken by certificants of the Building Operator Certification (BOC) program were attributed to continuing education required in maintaining the professional credential. In 2013, the BOC program administrators surveyed certificants about their motivation for maintaining their certification through continuing education and found that respondents reported "employer support" as a key motivator for maintaining the credential. To evaluate this finding, the program administrators initiated a study in 2014 to test the influence of two communication interventions targeted to the employers of certificants on maintenance of certification (MOC) rates. This presentation will discuss the study design, methodology and results. The experimental design relied on randomization of 851 supervisors (of 1154 certificants) in the control and two intervention groups. The employees of Group 1 supervisors (control) received the standard reminder and instructions through postcards via mail and email. Group 2 supervisors, the "basic social marketing" group, were sent a letter (mail and email) providing the relevant benefits of MOC and asking them to support the specific employees due for MOC. Group 3, the "enhanced social marketing" group, received the same letter as Group 2, plus follow-up phone calls. Early results show an incremental increase in MOC rates from the control group to the two social marketing groups. Among the Group 3 respondents who committed to help certificants with maintenance, approximately 26% of their employees actually have completed the process so far, compared to 22% in the control group. These findings suggest that employer commitment to supporting their certificants' MOC is strong and barriers are relatively low. The costs associated with the interventions will be presented and elucidated. This study contributes to the understanding of how employer engagement can influence employee behavior and offers a model for evaluation of behavior-based measures. What was learned here can help inform best practices for training and certification of personnel programs; professional development policies within organizations; and national efforts including, but not limited to, the U.S. Department of Energy's Better Buildings Workforce Guidelines.

2D: Unlocking Behavior-Based Energy Savings in Commercial Buildings

Moderator: Dan Seligman, MEA

Speaker: Karen Ehrhardt-Martinez, Human Dimensions Research Associates

Unlocking Behavior-based Energy Savings in Commercial Buildings: The Unexpected Connection between Attitudes, Behaviors, Organizational Culture and Energy Savings.

Commercial buildings are the places that we work, shop, eat, and pray. Altogether, they are responsible for nearly 1/5th of total U.S. energy consumption. They also represent an important opportunity to save energy by means of both energy-efficient technology investments as well as shifts in energy service demands and wasteful energy practices. Nevertheless, unlocking behavior-based opportunities requires the ability to pinpoint specific energy savings opportunities at the building or organizational level and to help tenants engage in such efforts through the development of tools and methodologies that make it both easy and desirable. To this end, we began work on a commercial building demonstration project in the Pacific Northwest in November 2013 with the goal of reducing energy consumption solely through shifts in tenant behaviors and workplace practices. The program was designed to push the boundaries of energy savings through the development of a set of innovative energy savings assessment tools and engagement strategies. Among the program goals, we were interested in exploring the ways in which individual attitudes and beliefs and organizational culture play a role in shaping: 1) individual willingness to participate, 2) individual energy savings strategies, 3) measures of individual engagement, and 4) the resulting energy savings. We hypothesized that pro-environmental attitudes would result in a greater willingness to participate and greater individual commitment to a more extensive set of energy savings strategies. We also expected that individuals with strong environmental attitudes would have higher levels of program engagement and achieve greater energy savings. Using data from the demonstration project, we explore the empirical evidence for these relationships and the ways in which organizational cultural may serve to mediate, moderate, or amplify the effect of individual attitudes on program participation and energy savings in organizations, businesses and commercial buildings. Initial results suggest support for an interesting mix of the hypothesized relationships.

2D: Unlocking Behavior-Based Energy Savings in Commercial Buildings

Moderator: Dan Seligman, MEA

Speaker: Danny Molvik, Energy Market Innovations

Encouraging Changes in Commercial Customer Energy-Efficient Behaviors through Energy Benchmarking Reports

As energy efficiency programs mature and the low hanging fruit disappears, utilities are increasingly looking for ways to motivate reluctant customers to embrace energy efficiency. One model to take off recently for residential customers are home energy reports, which show customers how their energy usage compares to neighbors. The design and implementation of these reports are grounded in behavioral science theories and are meant to motivate behavioral changes. Based on the initial success of these home energy reports, utilities are just beginning to pilot whether this approach can be adopted to motivate commercial customers. Given the unique sets of barriers and constraints that face business owners, a crucial question for these business energy reports is to understand whether comparative energy usage information will motivate them to adopt energy efficient behaviors and technologies. This presentation will begin to answer that question with results from in-depth, qualitative user research with business energy report recipients. Through their Energy Check Pilot Program, Consumers Energy's has been sending small commercial customers regular reports detailing how their energy consumption stacks up against comparable peer businesses. Each report highlights different tips and recommendations, and the reports direct customers to an online portal where customers can hear more about how to lower their energy use. The purpose of the pilot is to encourage all customers, especially those using more energy than comparable businesses, to make behavioral changes around energy use and invest in more energy efficient technologies. To assess how the comparative energy reports are being received early in the pilot study, we are conducting qualitative usability and collateral testing with a small sample of report recipients. Through this research, a certified usability expert has customers walk through the reports and/or online portal to discuss their perceptions and reactions to various elements and features. In addition to being among the first research on business energy reports, this research is unique among research on all comparative energy reports because of its qualitative focus. Most research to date has focused on billing analyses to understand the effect of these programs on customers' energy use. Instead of focusing on what the effect is, this research seeks to explain how these reports motivate behavior change. This presentation will share the results of the usability testing, highlighting customers' experiences and perceptions of the comparative energy reports. We will also discuss how this early feedback on program materials helps to inform program decisions for Consumers Energy early on in the pilot. We will also discuss the critical role that the comparative energy reports play in increasing the awareness and opportunities available to commercial customers for taking control of their energy costs and consumption. Specifically, this session will highlight: •Type of customers participating • Aspects of the reports customers find most useful • Challenges to customer engagement in the program • Impact of energy reports on customer energy related behavior and investments • Unexpected findings • Lessons learned • How findings are informing the program design

2D: Unlocking Behavior-Based Energy Savings in Commercial Buildings

Moderator: Dan Seligman, MEA

Speaker: Kathryn Janda, University of Oxford

Change from Within? Carbon Management in Commercial Real Estate

Currently, all firms and organizations pay energy bills, but not all actively "manage" energy. Where energy management does occur, it is usually driven by financial concerns or corporate social responsibility, rather than being treated as a strategic business opportunity [1]. Finding ways to link energy management and building retrofit efforts more closely to core business concerns and operational capacities follows a "middle-out" approach to environmental change. In a "middle-out" model, institutions lead through their own initiatives, rather than reacting solely to government regulation (top-down) or consumer demand (bottom-up) [2]. Generating greater activity from within the commercial real estate industry is critical. Social and institutional factors in energy efficiency decision-making have been understudied relative to technologies, yet they hold the key to significant market transformation in practice [3]. This paper provides results of a knowledge exchange partnership with a small company called CO2 Estates. CO2 Estates provides web-based carbon accounting and retrofit recommendations to many of the large commercial real estate (CRE) investment firms in the UK. The current CO2 Estates web tool details regulatory risk in portfolios, indicates business disruption of potential upgrades, and gives simple payback times for various technologies. The knowledge exchange builds on this diversity by further tailoring the existing tool to match client business strategies. Previously, the CO2 Estates approach contained different technical recommendations for different building types and conditions, but it did not explicitly tailor recommendations for different organizational types. Implicitly, it therefore assumed that there is either (a) essentially one kind of CRE firm, or (b) that all firms adopt carbon reduction measures in the same way. However, previous research suggests that there are at least four different CRE firm types depending on ownership type and portfolio size; moreover each firm type adopts energy efficiency measures for different reasons. Similar firms react differently to voluntary energy management opportunities, depending on their institutional context [4]. Depending on the company's level of environmental concern, physical conditions of the portfolio, and organizational capacity for change, there may be at least eight different categories of firms in the market [5]. The paper describes how this organizational diversity has been reflected in the enhanced web tool. It contributes insights based on this knowledge exchange that will help academics and policy makers understand different types and combinations of organizational logics used in making energy retrofit decisions.

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2E: Modeling Energy Savings

Moderator: Eric Rambo, Cadmus

Speaker: Dr Jeremy Vincent, Department of Energy and Climate Change

Does lifetime electricity running costs information lead consumers to purchase more energy efficient appliances? Results from a UK trial

The UK Government's Department of Energy and Climate Change is conducting a behavioural trial to test whether giving consumers information on the lifetime electricity running costs of certain appliances will result in the purchasing of more energy efficient appliances. This is a randomised control trial being implemented in 38 stores of the John Lewis Partnership, a major national department store, and involving approximately 40,000 product sales. The trial was announced as part of the Government's Energy Efficiency Strategy in 2012, recognising that a lack of trusted and appropriate information is a key barrier to deploying energy efficiency. The European Union's Energy Labelling Directive mandates that electrical product labels display their ranking in terms of their relative energy efficiency. However, energy use is only reported in kWh per year which is an abstract concept for some consumers. This trial is testing whether additional information on product labels giving average lifetime running costs for appliances will enable consumers to make better informed decisions and purchase more energy efficient goods, leading to an overall decrease in household energy use. A similar trial in Norway which tested lifetime electricity cost labels in some retail stores saw a 5% average reduction in energy use of sold tumble driers, but no effect for fridge-freezers where the total cost of ownership is less (Kallbekken et al. "Bridging the Energy Efficiency Gap: A Field Experiment on Lifetime Energy Costs and Household Appliances" Journal of Consumer Policy, 2013). In our UK trial, lifetime running costs are presented on the appliance labels of washing machines, washer dryers and tumble driers. John Lewis staff have been trained to answer any questions customers might have about the new information and in-store posters explain how the running costs have been calculated. The trial is a cluster parallel randomised controlled trial, where the intervention and control groups are tested concurrently and the interventions are purposefully designed. Randomisation between the intervention and control groups occurs at the John Lewis store level as opposed to the individual consumer level. This is due to the practicality of rolling out new labels to products in stores, and possible cross-contamination between staff in the same store. This design was also selected since it is simply not possible to randomly allocate each consumer to either the control or intervention arm when they first enter a John Lewis store. This is the first time this kind of running costs information is being tested through a trial in the UK. Following a pilot in late 2013, the trial is running live in stores for six months over Winter and Spring 2014 with results expected to be available in Summer 2014. These results will help to improve UK appliance energy efficiency policy and inform debate on product labelling at the EU and among retailers. There has been international interest in the trial from the US and Europe. This presentation would set out the results and their application.

2E: Modeling Energy Savings

Moderator: Eric Rambo, Cadmus

Speaker: James Turnure, US Energy Information Administration

Behavioral Aspects of Aggregate Demand in the National Energy Modeling System (NEMS)

Behavioral Aspects of Aggregate Demand in the National Energy Modeling System (NEMS) Jim Turnure, Director, Office of Energy Consumption and Efficiency Analysis, US Energy Information Administration, Washington, DC The National Energy Modeling System (NEMS) is the primary tool used for U.S. long term projections and analysis by the Energy Information Administration (EIA). Starting in 2011, the EIA has been investigating behavioral economics and aggregate demand specification, in order to determine the implications for NEMS and for demand-oriented modeling and analysis. EIA conducted methodological surveys and seminars, held a one-day external workshop in July of 2013, and worked with contractors on literature surveys, analytic reports, and options papers for simulation modeling. Finally, this year EIA has examined specific technical options and tested NEMS using modified behavioral parameters. As a general matter, aggregate demand in neoclassical economics relies upon a set of 'strong' assumptions which are necessary for the formal proofs and equations of economics to hold. While not strictly speaking necessary for computer simulation modeling, similarly simplified representations of behavior pervade energy-economic modeling. How much complexity, or probability-based technique, could be added to an already complex model to account for observed behavioral variance? This question is of key importance for determining what level of rigor is possible, independent of what might be suggested by a re-evaluation of aggregate demand specifications. In this BECC presentation EIA will put behavior-related issues into technical and policy context, describe the set of inquiries undertaken to date, and present analysis and conclusions concerning how behavior-related issues might affect energy demand, demand specification in models, and selected analytic applications.

2E: Modeling Energy Savings

Moderator: Eric Rambo, Cadmus

Speaker: Nat Treadway, Distributed Energy Financial Group (DEFG)

Prepayment, Conservation and Behavioral Change in the Utility Sector

Public power utilities in the U.S. have offered voluntary prepayment for household energy service for several decades. Other providers have taken note of this, and are offering prepay electric service in several states. Analysis of pre- and post-enrollment data has shown a linkage between prepayment and energy conservation, with annual reductions of five to fifteen percent. While a statistical link has been demonstrated, the behavioral changes are not well understood or documented. For example, past research has not differentiated between usage reductions that result from simple changes in household routines (turning off the lights), to changes in energy-efficiency investment behavior (purchasing a new light), and to customer adoption of strategies for self-disconnection/reconnection (tactical timing of the payment). There are also interesting issues relating to the design of the prepay service program, and the extent to which technologies (in-home devices or mobile apps), various design features (e.g., the use of new communications channels and the frequency and content of communications) and government policies (maintenance of customer protections in the smart-grid setting) have changed consumer behavior. There are also significant issues relating to the importance of personal responsibility and utility service. To what extent have consumers shifted from viewing the utility bill as something done to them, to viewing their prepay account as something that they control? The presentation will explore the recent work of DEFG's Prepay Energy Working Group, created in 2010, with insights on consumer satisfaction with prepayment and energy conservation savings. Finally, we will comment on the context for prepayment in the U.S., drawing distinctions between public power offerings, investor-owned utility pilot programs, and prepay service offered by competitive energy retailer in Texas. The presentation will help the audience to understand energy prepayment as a new smart grid offering that can transform the residential sector and set the stage for serious customer engagement with energy consumption and energy utilities.

2F: Getting to Gold Medal Utility Programs

Moderator: Hayes Jones, US DOE

Speaker: Alexandra Dunn, Research Into Action

Leaping from the ivory tower and landing on firm ground: How active collaboration between academics, evaluators, implementers, and program managers can create effective and scalable behavior programs.

Utilities are investing increasingly greater resources in behavior-based programs, but the integration of behavioral theory into the energy efficiency program portfolios has yet to reach its full potential. Current behavior pilots often fall short of providing scalable and evaluable programming that is capable of generating comprehensive and cost-effective energy savings, perhaps due to an over reliance on a small subset of intervention strategies. Over half of the programs on CEE's 2013 Behavior Program Summary sample of behavioral programs use a home energy report model, and roughly a third provide some kind of gift or incentive. On the other side of the spectrum, academic pilots are often designed with specific manipulations aimed at testing theoretical nuances vital to encouraging a deeper theoretical understanding at the cost of scalability for full-fledged utility programs. How can we realize the full potential of theory-driven behavioral interventions and develop effective energy efficiency programs within the landscape of today's energy efficiency market? Drawing upon our experience in pilot design and evaluation, this presentation will discuss strategies for overcoming the gap between theoretically driven, and often lab based, experimental studies and real-world program design. We argue that the most successful programs are those where specific, experimentally validated intervention strategies are tailored towards a specific behavior change goal within population of interest. Further, active collaboration between program managers, program implementers, and independent experimental design and behavior experts will help to strike a balance that successfully applies behavioral theory in the messy reality of energy consumption and policy constraints. We will provide examples of successful application of this approach in the design of residential behavior pilot programs that incorporated underused behavior strategies, like public commitment, prompts, and foot-in-the-door techniques, to change specific behaviors, among targeted segments of the population.

2F: Getting to Gold Medal Utility Programs

Moderator: Hayes Jones, US DOE

Speaker: Jay Kassirer, Cullbridge | Tools of Change

BC Hydro's Team Power Smart Behavioral Program: Recent results and future directions

Since 2007, BC Hydro has run an opt-in loyalty program called Team Power Smart that has been successful both in engaging BC households in energy conservation, and in engaging them more deeply over time. It was chosen by a peer selection panel as a Tools of Change Landmark case study in 2011. The behavioral program uses tools such as storytelling, co-creation, challenges, prompts, and individualized feedback. In addition, it offers participants the opportunity to participate in successive 12-month challenges and to earn a small reward ($75) if they reduce energy consumption by 10% or more, calendar-normalized and weather-normalized. Those who have completed a challenge are able to take further challenges, to reduce their energy use even more and earn additional rewards. The corporation developed a new engagement model specifically for this demand-side management program. This model forms the core of the program strategy, which is designed to increase participants' engagement levels on three dimensions: Enjoyment ("I like this"), Affiliation ("This is who I am"), and Resonance ("This is right for me"). Each program activity was designed to increase engagement on one or more of these dimensions and to lead to further action. For example, a sense of affiliation with the program has been established over time through the loyalty group model and membership exclusivity, norm appeals, word-of-mouth promotion from friends and family, and program messaging that plays to and reinforces pride in the province and its natural heritage. In addition, the program offers a wide range of participation opportunities at varying levels of engagement, from visiting the program website (more passive) to contributing personal stories, photos and original marketing ideas or hosting events at home (more active). Membership in the program has been growing steadily. Each year, an increasing number of members have taken the energy reduction challenge, and more of them have gone on to take subsequent challenges to lower their energy use even more. Further, a growing proportion of those taking challenges have reduced use by 10% or more, and the average net program energy savings per member household has been rising. Program management has begun to investigate the persistence of the savings, now that multi-year data are available from a substantial number of participants. Early findings indicate that program participants who have completed a challenge and who have not yet signed up for a further challenge slip back only marginally during the intervening period. Impact Evaluations have assessed the behavioral energy savings for the period 2009-2013 at 25.6 GWh. Future directions will also be discussed, including integration with smart meters, a new approach to tracking progress towards one's goal, and increased use of segmentation in member communications. In addition, the program will begin offering different incentives for different types of challenges, and will introduce a maintenance challenge to support persistence of the behavioral energy savings in households that are no longer in a competition to reduce energy use.

2F: Getting to Gold Medal Utility Programs

Moderator: Hayes Jones, US DOE

Speaker: Rebecca Brown, BKi

Bringing It All Together: Innovations in the Alameda County Residential Behavioral Pilot

Many energy efficiency behavior studies to-date have examined narrowly constructed interventions rather than broad, comprehensive efficiency/usage upgrades. This limited approach facilitated scientifically rigorous findings in a nascent field of study. However, in practice, energy efficiency incentive programs seek much larger savings than produced by limited interventions alone. In order to maximize the impact of the interventions, efficiency program implementers have started to integrate behavior interventions with efficiency incentive programs, thus expanding the energy savings potential of each participant. With this in mind, the Alameda County Residential Behavioral Pilot built on past behavior studies to integrate effective participant engagement with no- and low-cost physical upgrades, multi-tiered interventions, and whole-house energy approaches. Alameda County designed its innovative Behavioral Pilot to include the following key elements: • Use hourly SmartMeter analytics to perform inexpensive remote "audits" to automatically disaggregate kilowatt-hours and therms into one of five end-use categories (space heating, space cooling, variable loads, recurring loads, and base loads) • Combine remote audits with participant screening surveys to identify specific energy end-use behaviors or appliances that can be altered or upgraded to achieve savings • Pre-sort enrollees into different intervention groups (high baseload, high HVAC, low overall energy) based on their energy use profile, deliver tailored messaging and targeted follow-up • Provide monthly electronic and telephone feedback and education customized to each participant based on their ongoing energy use analytics with one-on-one phone consultations to review progress and behavior change commitments • Layer behavior feedback interventions with home energy upgrade measures for the "high HVAC" participant group • Stack extrinsic motivators (e.g., prizes) and intrinsic motivators (e.g., social rewards) • Provide ongoing, real-time energy savings evaluation through automated analytics in conjunction with traditional analysis tool In this presentation, we will discuss successes and challenges of this complex and custom program design. We also will present 12 months of participant engagement and weather-adjusted energy savings results and compare overall and disaggregated energy end-use savings for each intervention group. Preliminary results show an annual average 2-3% (50MWh) electricity savings and 7-8% (11,000 therms) natural gas savings among over 300 participants. We predict that future program data will reveal synergistic energy savings effects among customers who participated in both the behavior intervention and the home energy upgrade program. Program partners include BKi (program design, targeted customer follow-up, and results analysis), StopWate (program design and oversight, marketing, and outreach), Home Energy Analytics (energy analytics tool, data collection, and results analysis), Portland State University (participant survey), and Lawrence Berkeley National Laboratory (energy data analysis and interpretation).

2F: Getting to Gold Medal Utility Programs

Moderator: Hayes Jones, US DOE

Speaker: Chris Jones, UC Berkeley

Going Deeper: A Review of Competitions and Community Based-Social Marketing Programs for Reducing Energy Consumption

Electric and natural gas utilities are increasingly pursuing science-based approaches to encourage energy efficiency and conservation. In California, utilities have experimented extensively with comparative and targeted feedback using home energy reports by companies such as Opower. These programs have consistently achieved 1-3% energy reductions but have failed to achieve deep savings among target populations. In recognition of untapped potential, the California Public Utilities Commission (CPUC) is encouraging California's investor owned utilities to explore programs that employ a broader set of behavior change strategies. This white paper, commissioned by the CPUC, develops and analyzes case studies of two promising approaches: energy reduction competitions and community-based social marketing (CBSM) programs. Through literature review and interviews with dozens of program implementers, evaluators and topical experts, we explore the design, implementation and evaluation of these programs, asking such question as: What are the primary motivations of program designers? To what extent have programs met expectations? What strategies worked well? What are the barriers to successful implementation and how can these be overcome? How have outcomes been measured and how may measurement be improved given program design constraints? To what extent have programs been scaled up and what are the barriers and opportunities for scaling? How cost-effective are programs compared to existing behavior programs focusing primarily on comparative feedback? The research will conclude with a final report to the CPUC in Fall of 2014 that will be made available as part of a series of white papers by the California Institute for Energy and Environment on behavior and energy. This presentation will present major findings and recommendations for funders, program designers, implementers and evaluators.

3A: Lightning: Program Evaluation

Moderator: Michael Li, US DOE

Speaker: Amy Meyer, Navigant

Driving Savings from Behavior Programs: The Role of Program Theory & Logic Models in Program Design & Evaluation

Driving Savings from Behavior Programs: the Role of Program Theory & Logic Models in Program Design & Evaluation Behavior-based programs present a great opportunity to drive resource savings beyond traditional widget programs. However, a lack of consistent stakeholder support for different types of behavior programs can undermine a program sponsor's desire to design new and innovative ways of motivating behavior change. Additionally, stakeholders may quickly deem programs unsuccessful if program intentions and goals are not clearly documented. Program managers should draft program theory and logic models early in the design phase to improve alignment with the stakeholder approval and program evaluation processes. Program theory and logic models document program intentions, devise clear and quantifiable goals and metrics, and can assist in driving discussion among program stakeholders. Deployment of behavior programs is increasing across the United States, especially in the energy utility sector. The utility sector has successfully launched hundreds of behavior programs and efforts to develop uniform measurement methods and evaluation standards for behavior programs have made great progress over the past decade. However, consistent development of program theory and logic models is not widespread. An absence of program theory and logic documentation often results in vague definitions of program goals, activities, target audiences, and, most importantly, measurable performance indicators. This lack of clarity will present challenges during implementation and evaluation, and in some cases has led to early cancellation of programs. ACEEE recently recognized the need for behavior program designers to develop program theory and logic models to increase program effectiveness in driving cost-effective resource savings in its Field Guide to Utility Run Behavior Programs. Based on the author's experience developing program theory and logic models for various energy utility behavior programs across the country, this presentation will illustrate the process and value of documenting a behavior program's target barriers, target audience, inputs, activities, outputs, and intended outcomes in a program theory and logic model. The presenter will discuss the key components of a program theory and logic model for behavior-based programs, including the key performance indicators that drive the quantification of energy savings during the evaluation process.

3A: Lightning: Program Evaluation

Moderator: Michael Li, US DOE

Speaker: Merrilee Harrigan, Alliance to Save Energy

Behavior Savings in Schools: a scalable program achieving 5-15% savings through student-led campaigns

Residential behavior programs have become accepted energy efficiency resource programs. Commercial behavior programs, on the other hand, are not yet established as resource programs but have enormous potential to yield savings through behavior. This presentation will describe one school-based commercial behavior program, the Alliance to Save Energy's PowerSave Schools Program, which has a 17 year track record of achieving electrical savings from of five to 15%. In 511 schools over 5 years, the per-school electricity savings averaged 10.5% through no-cost behavior change alone. The behavior producing the savings is initiated by students, who conduct energy audits of classrooms and common areas using diagnostic tools including watt meters, light meters and infa-red temperature sensors. Students collect data, quantify potential energy savings and develop campaigns that induce teachers, students and staff to save energy by reducing classroom over-lighting, eliminating unneeded plug loads and managing thermostats. Campaigns use CBSM techniques such as social norming, respected experts, incentives and competitions. Electricity savings are measured through bill analysis using Utility Manager Pro, establishing a 12-month baseline, and adjusting for weather and changes in square footage, schedules and equipment. Persistence of behavior savings will also be addressed, including anticipated research that will look at utility data from participating schools for several years after the program ended, in order to determine the degree of persistence; some of that data is expected to be available for the presentation.

3A: Lightning: Program Evaluation

Moderator: Michael Li, US DOE

Speaker: Phil Bosco, Ontario Power Authority

Prelminary Results from the Impact Evaluation of TOU Rates in Ontario

Overview: This presentation will give an overview of the current results of a 3-year evaluation study of the impact of mandatory time-of-use rates in Ontario. The Canadian province of Ontario is the only region in the North America to roll out smart meters to all its residential customers and deploy mandatory Time-of-Use (TOU) rates. TOU rates were deployed to incentivize customers to curtail electricity usage during the peak period and to reduce overall electricity usage. The impact evaluation of Ontario's full-scale roll-out of TOU rates is a three-year project with the following objectives: (i) Quantify the change in energy usage by pricing period for the residential and general service customers; (ii) Estimate the peak period impacts; (iii) Estimate the elasticity of substitution between the pricing periods and the overall price elasticity of demand. Each local electric utility in Ontario managed its TOU rate deployment independently. In order to implement TOU rates, utilities had to first install smart meters that recorded interval data. Once they had smart meters installed, they could rollout the TOU rate to their customers. Both smart meters and the TOU rate were rolled out at different dates and over different time scales across the utilities. Two customer classes were examined: residential class (single family homes and individually metered apartment buildings) and general service class (customers are non-residential customers with demands less than 50 kW). Results: The key findings are: • Residential customers show a consistent pattern of load shifting behavior • General service customers show less consistent patterns of load shifting and are less responsive to the TOU prices than residential customers; In terms of the residential class results, there is significant evidence of load shifting across all LDCs: • There is reduction in usage in the peak periods increase in usage in the off-peak periods; • Load shifting is higher in the summer rate periods than in the winter rate periods; • Peak demand impacts range from -1.3% to -5.6%, depending on the utility studied; • Peak period substitution elasticities range from -0.12 to -0.27 • Evidence on energy conservation due to the TOU rates is limited, being very small or zero. Innovative rate designs are one of many options utilities can use to drive energy efficient behaviour in their customer base. The results of this study can help inform other utilities about any rate designs they are considering, and highlight the challenges in evaluating rates designs that are deployed in a mandatory and holistic fashion.

3A: Lightning: Program Evaluation

Moderator: Michael Li, US DOE

Speaker: Martin Kushler, ACEEE

Examining the Fossil Record: A Fun Look Back at some of the Earliest Energy Education Research

Examining the Fossil Record: A Fun Look Back at some of the Earliest Energy Education Research In the beginning, there was the OPEC oil embargo. And there was angst and discomfort upon the land. And the nation took the counsel of the engineers and geologists, but little was asked of the behavioral scientists. Richard Nixon begat Gerald Ford, who begat Jimmy Carter….who said "Enough! Something must be done!" In 1977 the U.S. Energy Research and Development Administration (precursor to the U.S. DOE) created the "Energy Extension Service", and grants were provided to 10 states to launch efforts devoted to energy conservation. Michigan was selected as the lead state for efforts involving energy education, and began work in January of 1978. The author, a graduate student at the time, was hired to help design the project and manage the evaluation of Michigan's efforts at energy education. By the time the work was finished in 1981, Michigan had designed and disseminated several examples of educational curricula for middle and high school teachers; conducted a true field experiment testing methods of reaching and influencing teachers (conveniently turned into a doctoral dissertation); and developed a comprehensive "Youth Energy Survey" instrument with reliable attitudinal and behavioral scales - - which was produced in an "optical scan" format and ultimately used by teachers in over a dozen states around the nation. The purpose of this presentation will be to acquaint the current crop of behavioral scientists (many of whom were not born when this work was conducted) with some of the early history of the field. The context for this work at the time will be described, and key results will be briefly summarized. But mostly this should be a "fun" opportunity to learn about some of the early days of behavioral energy research.

3A: Lightning: Program Evaluation

Moderator: Michael Li, US DOE

Speaker: Douglas Tsoi, Northwest Energy Efficiency Alliance

Towards a More Rigorous Approach to Energy Efficiency Training

American industries annually spend more than $100 billion on training and less than 10% of these expenditures results in a transfer of new skills to the job. With energy efficiency programs becoming increasingly depending on skills acquisition, utilities and other energy efficiency organizations need to ensure that their training programs cost-effectively lead to increased job performance and capacity. Energy efficiency trainings need to be designed to ensure skills are learned and used in the field and this needs to be coupled with a program to measure the savings resulting from them. This paper will describe the Northwest Energy Efficiency Alliance's implementation of best practices for its suite of energy efficiency training programs. Key to the training regime's redesign is a focus on both declarative and procedural knowledge through deliberate practice and persistence. This paper will discuss effective strategies for corrective and confirming feedback that integrate themselves seamlessly into training sessions. Also addressed will be pre- and post-training barriers to skills acquisition and implementation such as sending the wrong people to trainings lack of manager support/resources/feedback, no clear expectation to use skills and no time to use skills. Lastly, the paper will discuss the problems and opportunities of establishing greater rigor in evaluation of learner retention and correlating learning to energy savings.

3A: Lightning: Program Evaluation

Moderator: Michael Li, US DOE

Speaker: Nicholas Lange, Vermont Energy Investment Corporation

The Real Problem With Behavioral Savings (And What We Can Do About It)

Lifetime? Persistence? Double-Counting? Each of these issues have been the focus of research and analysis, but most efforts to date have done so in an isolated way that fails to notice or address the underlying issue that unites them: we know very little about the substantive details regarding the existence of and future potential for sizable savings. Our industry finds itself thrust into the position of forecasting, planning, and executing on the delivery of a demand-side solutions without a firm grasp of the details of an increasingly significant potential resource. This is the REAL problem with behavioral savings. It arises from a sober look at how the operating assumptions and constraints have changed over the past two decades. From this privileged perspective, it appears as if there may be a fundamental incompatibility between the two dominant, but distinctly different, methodologies for quantifying and attributing cost and savings impacts. Though each approach has passed muster through multiple independent evaluations, the relatively isolated assessments seems to have missed a glaring oversight: the makeup of behavioral savings may be majority made-up of equipment and product savings due to a higher than control rate of retirement or replacement. This is strongly suggested by an artifact of how the different processes for determining savings when behavioral and conventional programs are run side-by-side. For example, consider that a conventional HVAC program would claim savings for a new high-efficiency unit by comparing an estimate of consumption relative to a new baseline unit. A behavioral program would measure the change in consumption between the new unit and the old unit. For typical sizes and specifications, the “savings” from the former approach is about 1/3 of the “savings” from the latter. Thus even after the deemed savings are subtracted—as is commonly done to avoid “double-counting” the behavioral program will retain 2/3rds of the “savings” from the equipment upgrade for as long as it takes the control group’s upgrade activity to catch-up. The purpose of proposing this topic is to help draw attention to the issue, and propose a productive and forward-thinking industry response. We need an an open and unflinching review of the issues, so that we can find a path that sheds new light into the behavioral “dark matter” of energy efficiency programs.

3A: Lightning: Program Evaluation

Moderator: Michael Li, US DOE

Speaker: Jenny Hampton, Navigant Consulting

Meta-Analysis Identifying Energy Saving Actions Taken in Households

This study will add to the growing, but still limited, body of research surrounding energy saving actions taken by utility customers who receive home energy reports. The study will present results from a meta-analysis of responses to phone survey questions about actions taken inside homes before, after and in the absence of home energy reports. The presenter will discuss results from surveys of customers from five different electric and gas utilities across the United States. The evaluated programs will represent varying mixes of program implementation models (printed reports, email reports, web portals), climate (Midwest, East Coast, Rocky Mountain region), and participant types (high users, low income, urban, rural). The analysis will also include responses from several non-participant surveys. Analysis will be complete in Fall 2014 and will include customer surveys conducted by phone between 2012 and 2014. The presenter will also share lessons learned from evaluation approaches and recommendations for future survey methodologies. Identifying which energy saving actions are adopted by program participants in behavioral programs will further refine our understanding of the persistence of energy savings achieved by such programs, in part to help determine how frequently utilities should provide feedback, and how long utilities should run feedback programs. This knowledge will also help inform measure life calculations for behavioral program inclusion in energy measures databases and technical resource manuals. Finally, understanding which actions are taking place in homes can help behavioral program implementers improve program design and efforts to channel participants into other energy efficiency programs run by the utility.

3A: Lightning: Program Evaluation

Moderator: Michael Li, US DOE

Speaker: Dawn Bement, Skumatz Economic Research Associates

Has the Local Community Energy Concierge Model Worked?

A host of community-based concierge model programs were implemented using stimulus grants and funds. This project reviewed the performance of individual programs, but also examined design and performance information across programs to identify success features that could be transferred to new programs. We conducted detailed interviews with more than a dozen energy concierge programs across the nation (large and small) to analyze designs, understand performance variations, and provide lessons learned and tips for best practices in energy concierge / coach models for residential and commercial programs. In the analysis, we: • Assessed similarities and differences in design elements, including services, web tools, financing, etc. • Examined evaluation methods used for the programs, commenting on the reporting methods as well as the conformance with generally accepted evaluation practices, • Compared and benchmarked data on performance statistics, • Identified "success" characteristics, • Reviewed costs, and the way in which costs are allocated between outreach, incentives, etc., and • Summarized tips and suggestions from the program managers. The results – narrative and tabular – provide information useful in assessing the success of this type of program model, examining the savings that can be expected, the outreach and incentives used, and the related uptake. The project provides a review of a popular program model, bringing lessons from cross-program comparisons to bear in recommending those elements and designs most associated with strong performance in both residential and commercial programs, and to identify some of the best practices for this class of programs.

3B: Marketing Lessons in Domains Beyond Energy

Moderator: Valerie Richardson, IMT/DNV GL

Speaker: Dena Gromet, The Wharton School, University of Pennsylvania

Sparking Interest in Solar Adoption: How Messaging Affects The Choice to Engage with Solar Power

One of the first steps in individual solar adoption is getting individuals to spend time learning about solar power. This initial step can be a significant roadblock to solar adoption, as individuals have many demands on their attention and time, including other home improvements they may want to pursue. How can individuals' interest in solar power best be sparked? Previous research suggests that the messaging used to communicate about energy may be influential, particularly based on whether these messages resonate with individuals' political values (e.g., Gromet et al., 2013; Hardisty et al., 2010). The language of reduction that is often used in energy and environmental campaigns (e.g., "reduce your utility bills"; "reduce, reuse, recycle") may be particularly effective at motivating liberals who value energy conservation, but may fail to engage more politically conservative individuals who do not share this value. In two experimental studies, we examined the causal effect of different messages, and its interaction with political ideology, on individuals' choice to spend time learning about installing solar panels in their homes. In Study 1 (N = 905 California homeowners), participants were given the choice of four different home improvement options to read about, once of which was installing solar panels. We varied how solar panel installation was framed based on message type (reduction of negative aspect of energy usage versus increase of positive aspect) across different message contents (environment; money; independence from utilities). For example, participants who received the environmental reduction message read, "Want to reduce your carbon footprint? Get solar panels!". The type of message (reducing a negative versus increasing a positive) interacted with political ideology to predict choice. Across all message contents, liberals were more likely than conservatives to choose to learn about solar when a "reduce" message was used, whereas this ideological divergence was lessened was an "increase" message was present. In Study 2 (N = 621 California homeowners), we aimed to replicate the pattern using different message content (i.e., "reduce your use of fossil fuels" versus "increase your use of renewable energy"), and to investigate why this political divergence differentially occurs. Participants only had two home improvement options from which to choose: solar panels and landscaping (these were equally popular choices in Study 1). Once again, liberals were more likely to choose to read about installing solar panels when the "reduce" message was used than were conservatives, and this pattern was reversed when the "increase" message was used. Additional questions revealed that "reduce" messages were more appealing to liberals for two reasons: (1) these messages communicate that individuals have a personal responsibility to conserve energy, and (2) these messages also lead to the perception that solar will be more effective at lowering carbon emissions. These findings demonstrate that whether a message highlights reducing a negative aspect of energy usage or increasing a positive aspect can affect whether individuals take that first step in becoming solar adopters, and further stress the importance of understanding how individuals political values can influence their energy choices.

3B: Marketing Lessons in Domains Beyond Energy

Moderator: Valerie Richardson, IMT/DNV GL

Speaker: Ulla Kainz, Straubing Center of Science

Non-hypothetical willingness to pay for biobased consumer products

Biobased plastics are produced from biogenic resources and constitute a renewable and resource saving alternative to conventional, crude-oil based plastics. The biobased version and the conventional version of a product look the same and have the same tactual characteristics. Thus, consumers need to be informed about the specific characteristics of biobased products. To determine information contents and types that affect consumers' decision making we measured willingness to pay for two biobased products in different information treatments. We expected that different contents and types of information on biobased plastics have different effects on willingness to pay (WTP). We experimentally tested these effects with an incentive-compatible 8th-price auction. 227 participants were divided into six treatments where they received different information contents and types in different orders. Participants stated their willingness to pay for real biobased products. At the end of each session one randomly drawn biobased product was sold to the seven highest bidders for real money. Biobased sunglasses representing a life style product and a biobased toothbrush representing a basic commodity were offered simultaneously in all treatments. Participants who were informed with a text about the origin and resources of bioplastics were willing to pay on average 46% more for the biobased sunglasses and 48% more for the biobased toothbrush than the control group that was not informed about the biobased characteristic of the products. The mean WTP for the text treatment of the basic commodity was significantly higher than the mean WTP for the control treatment. Participants who were confronted with products labelled 'renewable resources' were willing to pay 94% more for the life style product and 100% more for the basic commodity than the control group. The differences of the mean WTP of the control treatment and the label treatment were significant for both product types. Even though participants were informed about negative and positive aspects of biobased plastics the higher overall willingness to pay for the biobased products illustrates their positive perception of this renewable material. One reason for the acceptance of higher prices for biobased products might be a willingness to act more environmentally and climate friendly. The highly significant effect of the label on willingness to pay indicates the effectiveness of information that is short and easy to process and shows that consumers rely on labels.

3B: Marketing Lessons in Domains Beyond Energy

Moderator: Valerie Richardson, IMT/DNV GL

Speaker: Jeff Becerra, StopWaste

Improving Recycling Performance through Recognition and Feedback

Most of us say that recycling is important, but are we good at it? StopWaste, a public agency responsible for reducing waste in Alameda County, CA, has spent the past few years using behavioral science practices to improve recycling habits, and looking at garbage carts to measure results. The work includes: • A Ready Set Recycle outreach program that uses recognition and rewards as motivation to improve recycling performance • Random, anonymous measurements of how much garbage, recyclable and compostable material is in garbage containers in Alameda County • Reports sent directly to garbage service account holders describing what was found. As a result of this and other related work by cities and waste haulers, Alameda County households have stepped up and reduced the percentage of recyclable or compostable materials in their garbage carts from 60% to about 32% since 2008. The proposed presentation for the 2014 BECC Conference will cover: • Review of prior field research showing the efficacy of using feedback, both individual and group, to improve community recycling rates • Challenges of providing meaningful, understandable feedback when measuring the amount of "good stuff" in garbage cans • Rationale for which behavioral biases were selected when motivating and communicating with garbage account holders • Multi-year recycling performance data • Lessons learned

3B: Marketing Lessons in Domains Beyond Energy

Moderator: Valerie Richardson, IMT/DNV GL

Speaker: Megan Billingsley, ILLUME Advising, LLC

Water-Energy Nexus: Public Perceptions and Motivations to Save Across Resources

If there is one resource Californian's care about, it is their water. Facing record drought conditions, Governor Jerry Brown declared a drought State of Emergency in January 2014 and residents were put on high alert. However, few consumers understand how electric and water use are interconnected – drawing on one of these precious resources inherently impacts the other. In May 2014, the authors conducted in-depth qualitative and quantitative research with English, Spanish, and Mandarin-speaking Californian's to test public outreach and messaging strategies for State of California's Statewide Marketing and Outreach Program, Energy Upgrade California's "water-energy nexus" campaign as part of a joint partnership between the California Center for Sustainable Energy (CCSE) and the Association of California Water Agencies (ACWA). In this paper, we examine which messages resonated the most with Californians, and how awareness of water scarcity can be leveraged to communicate energy conservation, and vice versa. The "water-energy nexus" describes the intersection of water consumption and energy use. Studies conducted by the California Energy Commission have documented how energy use in water treatment, the disposal of wastewater, energy used to heat and consume water account for 19% of electricity consumption and 4,600 gallons of water are required to generate 1 megawatt energy. Despite these staggeringly high figures, the public is largely unaware of the intersection of these commodities, and how the choice to consume one of these resources directly impacts the other. To test the most effective messaging strategies for the EUC's water-energy nexus campaign, the authors conducted eight focus groups across California and interviewed approximately 1000 residents through an online panel survey and targeted intercept surveys. With a focus on representation, this study was careful to include research across all California regions (northern and southern, urban and rural), and across California's primary ethnic groups (Spanish-speakers and Chinese Mandarin-speakers). In this paper, we will discuss our findings overall and highlight the differences in water-energy nexus awareness, messaging relevance, across regional and ethnic groups. In the presentation, we will share our findings "in the words of" of Californians and highlight the ways energy-water nexus language takes on a different meaning depending on who you're speaking with and where. The relationship between energy and water usage will only intensify as each resource becomes scarcer. Further, most residents are aware of their water use – it is a visible and tangible resource that they can "feel" and "see." Water-energy nexus messaging is not only necessary to conserve each of these resources, it also offers a rare opportunity to link and leverage consumer's concern for water conservation with energy messaging strategy, making energy conservation a more visible and immediate mandate.

3C: Challenges and Opportunities Targeting Small & Medium-Size Enterprises

Moderator: Susan Norris, PG&E

Speaker: Rory Bakke, True Market Solutions

A "Living Laboratory" Approach to Improving Utility Program Engagement

As utilities and regulators across the United States seek to achieve mandated resource efficiency goals, they are increasingly investigating the deployment and accounting of behavior-based energy efficiency and demand response programs. Because these programs are a relatively new means to drive energy efficiency at utility scale, few documented approaches currently exist, resulting in a dearth of data and scant opportunities to apply and test initiative theories. The need is emerging for a much greater understanding of how to leverage and measure action to reduce energy use in all sectors to meet regulatory and practical objectives and requirements. Simultaneously, it is clear that a focus on behavior change (and the programs and incentives that support it) is a critical next step in utility engagement to meet the nation's energy and resource conservation targets while reducing the carbon intensity of both residential and CII (Commercial, Industrial and Institutional) practices. This is especially true for the CII sector as most of the focus to date has been on residential programs and incentives. Over the past two years, True Market Solutions (TMS) has been developing and testing a program — Sustainability Circles — for small to medium-sized enterprises (SMEs) that has begun to show promise in using behavior-based change management strategies to induce businesses and public agencies to reduce carbon emissions, decrease energy and resource demand, and build mechanisms for continuous sustainability improvement. Key objectives of the Circles include: 1) integration of sustainability thinking, environmental and social initiatives, and metrics into SME business and organizational models; 2) a greater understanding of the potential impact of SME targeted programs; 3) building a peer exchange platform to motivate action; 4) indentifying the behavioral drivers of utility program participation; 5) testing the savings persistence and measurement lifetime of Circle participant sustainability initiatives. Our work thus far with approximately 100 organizations has shown significant promise, with recent participating SME entities averaging over 30 sustainability initiatives each for a targeted annual savings of approximately $167,000 per company over 5 years. There is significant potential to build on this approach and further improve results by incorporating the emerging ACEEE Behavior Change Utility Program Taxonomy — essentially creating a Living Laboratory to test how the behavior change approach affects the uptake of various utility programs and incentives. We are currently investigating testing factors that could include internal validity — cause and effect relationship between the various frameworks being tested and the variables of interest such as peak demand practices and overall energy consumption; and external validity — utilizing the Beta Group to help validate conclusions transferable to the community of SMEs at large. In this presentation we will share our current behavior change approach for SMEs, detailing results thus far, as well as the potential advantages of designing in the ACEEE program taxonomy. We will discuss the opportunity to stack program aspects, such as rational, cognitive, and social types of programs that could lead to greater behavior change results; and the work with partners to test the internal and external validity of this change management approach.

3C: Challenges and Opportunities Targeting Small & Medium-Size Enterprises

Moderator: Susan Norris, PG&E

Speaker: Seth Nowak, American Council for an Energy Efficient Economy

Small Business Participation: This Time, it's Personalization

The energy operations, management, and energy-related occupant behavior within small commercial enterprises is a determining factor in the rate of greenhouse gas emissions from the small business sector. It is not just the buildings and facilities. There is an interrelationship between small business owner and employee behavior and the resulting rate of energy use and carbon emissions going forward into the future. Taking action to save energy in small businesses is not as widespread as in larger commercial businesses, be it through direct energy saving behaviors (getting employees to put computers in a low-power mode when not in use, for example) or indirect ones such as hiring energy efficiency performance contractors or signing up for and participating in utility-sponsored or administered energy efficiency programs. To describe and characterize what works for achieving consistent energy savings over time in the small business sector, we are conducting interviews and in-depth analysis of leading and award-winning small business programs with sustained high participation rates. The small business sector has historically been considered by the utility energy efficiency community to be a "hard to reach" area. This is due to the numerous barriers and challenges to overcome in order to inspire small business energy-savings action. Barriers include the up-front costs of energy saving actions and measures, lack of awareness and knowledge of what to do and the potential benefits to the business, and perceived lack of time. Business owners and managers face a wide array of options for possible energy saving actions including those around employee education and training, policies and operating procedures, installation of automated systems that work around intractable behavioral barriers (lighting occupancy sensors and timers when people don't turn off the lights), and installing energy efficient equipment and appliances. Interim findings indicate that, to get small businesses to take action and save energy, utilities are overcoming the barriers businesses face through the design and implementation of energy efficiency programs. Program participation is increasingly easy streamlined and simplified; financing is provided; and most important, communication, outreach, and education is carefully targeted to the type of business, market subsector, languages and cultures of the eligible and targeted small business customers.

3C: Challenges and Opportunities Targeting Small & Medium-Size Enterprises

Moderator: Susan Norris, PG&E

Speaker: Caroline Flory, Duke Energy

Driving Behavior in Commercial Office Buildings

Duke Energy recently completed the Smart Energy Now (SEN) pilot, testing the concept of behavioral change to drive energy efficiency in Uptown Charlotte office buildings. The pilot launched in October 2011 to 70 participating accounts in 59 buildings. The SEN pilot tested not only the information and level of engagement necessary to drive changes at the building management level, but also what was required to change occupant and tenant company behavior. The program focused on occupant engagement thru trainings, emails, newsletters and campaigns and provided real time energy usage to building managers and occupants through an online portal, a website and in-lobby kiosks that displayed aggregated energy consumption of the pilot participation. Based on the positive results and learnings from the recently completed Evaluation, Measurement and Verification report, Duke Energy plans to commercialize the program in Duke Energy Carolinas (DEC) and launch additional pilots in other customer segments and jurisdictions. In this session, Duke Energy will discuss learnings, the results of the pilot program and its plans for the commercialized program.

3C: Challenges and Opportunities Targeting Small & Medium-Size Enterprises

Moderator: Susan Norris, PG&E

Speaker: Kate Crosby, Acton-Boxborough Regional School District

Powering Down: Behavior-Based Energy Conservation in K-12 Schools

K-12 schools offer an exciting venue for implementing behavior-based energy conservation programs, with big payoffs in cost savings, student engagement and lowered carbon emissions. A new report published by the US Green Building Council, titled Powering Down: A Toolkit for Behavior-Based Energy Conservation in K-12 Schools, documents five case studies of highly successful "exemplar" behavior-based energy conservation programs in K-12 schools. The schools vary in attributes and are spread across the United States, but their effective programs are linked by shared strategies and by their successful outcomes. The schools have achieved astonishing reductions of 20-37% in electricity consumption over baseline entirely through behavior-based measures. Equally astonishing, they continue to maintain these savings 3 to 5 years out from the benchmark year, thus demonstrating significant persistence. Interviews with faculty and staff at the school and district level revealed multiple shared elements among these exemplar program including (1) strong engagement by students, enhancing creativity and positive attitude (2) engagement of custodial and kitchen staff (3) effective school leadership by faculty/staff member(s) with critical endorsement from the building administrator (4) targeted support for these programs at the district level, including access to energy data (5) powerful momentum from energy data as a feedback loop serving to increase commitment per faculty/staff report (6) additional momentum provided by recognition at building, district, state and national level, also per faculty/staff report. The study focused on behavior-based strategies in two categories: (1) influencing general occupant behavior (e.g., faculty turning out lights when departing a classroom) and (2) influencing behavior of custodial/facilities staff in tightening building operations (e.g., turning down hallway lighting shortly after the end of the school day). A significant synergistic effect among these categories in enhancing overall success was noted repeatedly in interviews. Study results as well as a literature review documented multiple benefits from these successful programs, including learning and leadership opportunities for students, substantial cost savings and a reduced environmental impact for school operations. Clear examples of the specific successful strategies employed in the five exemplar programs will be shared as well.

3D: Art & Behavior

Moderator: Marda Kirm, EcoArts Connections

Speaker: Niina Nurminen, ArtSense Ltd.

Arts, cognition and business in the transition to a low-carbon future

Arts, cognition and business in the transition to a low-carbon future Niina Nurminen, Ava Numminen, Vera Kiiskinen, Mari Pantsar-Kallio Two fundamental challenges regarding climate change are that 1 for lay people it is difficult to understand a concrete enough way what are the consequences of it and 2 how it could be mitigated if people in the wealthy part of the world would be more active in doing cleaner choices in their private and professional life. In Finland a movement called Storm Warning (Myrskyvaroitus), started in 2013, is addressing these two issues. Storm Warning was initiated by musicians worried for climate change and was expanded to actors and other professionals a year later. The main objective is that artists, as professionals in getting people's attention and being role models, could communicate these issues in a more efficient way and to activate people by "touching their souls". We aim to combine the latest knowledge of cognition, emotions and behavior to make the message positive, attractive, and concrete enough to encourage people to make better choices in their everyday life (e.g. Kahneman 2011 ; Lewandowksy et al 2012; Parks et al 2013). The artists, musicians and actors as professional story tellers convey the climate message in touching stories. We already have good examples how top musicians have made their impact: Rock musician Anssi Kela made a video clip about the climate change and invited his fellow musicians to join the Storm Warning Concert (Autumn 2013). A world famous singing group Rajaton with Kuusisto violin brothers made a concert tourney titled Two degrees (Spring 2014). At the moment there is a video project going on where famous actors and musicians tell about their personal climate actions. We also co-operate with a path braking concept of Dreamdo. Theatre can catalyze change, growth and learning. In addition to rational research data we must use other methods that will influence our feelings. The Forte- group is a theater group that uses a forum-theatre application (forum theatre founded by Augusto Boal) customised especially for organisational development. Workshops and development programs are planned in partnership with the customer to ensure that the fictional drama connects with the participants and the actual issues of the organization. Forum-theatre provokes dialogue between the participants and affects attitudes, beliefs and behaviours to make way for a better work-life. Many associations and movements are seeing businesses problematic in this transformation and aiming solutions that create low incentives for businesses. In Storm Warning we concluded that the solution should be the opposite. In order to have needed capital for the transformation, businesses should see this as huge business opportunity via low-carbon solutions. In this way we should invest ourselves away from the problems. This paper will illustrate the concept and lessons learned from the first year of operation. Jouni Keronen, PhD, MBA, has worked long time with energy industry with climate change related issues. He is a manager of Fortum Foundation, Senior Adviser for Senior Adviser for Sitra - the Finnish Innovation Fund and Adjunct professor in Lappeenranta University. Ava Numminen, PhD (Music), psychologist, singing teacher, works as an occupational psychologist and runs the KeyToSong singing school. She is a postdoctoral research group member of department of Educational Psychology at the University of Helsinki. Niina Nurminen is an actor with a long career in theater,TV and films. She is also a writer, director and Managing Director of Artsense and she has led 14 years the Forte group in Finland. Vera Kiiskinen is an actor, who has a long career in theatre, TV and film. She is also a screenwriter and director.Vera has been working for 7 years in the forum-theatre based Forte-group as an actor. Dr Mari Pantsar-Kallio is Director at Sitra, the Finnish Innovation Fund, leading the theme Resource-wise and carbon-neutral society. Prior to Sitra she has acted as Director of the Finnish Strategic Programme for the Cleantech Business in 2011-2013, and lead the Finnish Cleantech cluster in 2000-2007.

3E: Frontiers in Research & Understanding of Behaviors

Moderator: Margaret Taylor, Stanford University

Speaker: Renee Lertzman, Brand Cool

Beyond Behavior Change: Psychosocial Approaches to Supporting Low-Carbon Practices and Research

At this moment in history, we are witnessing an unprecedented expansion of the field of behavioral sciences and energy studies; specifically focused on public engagement, awareness and how to support large-scale shifts in our practices. This pertains to all contexts, whether focusing on stakeholder engagement with utilities, executing public awareness campaigns, or how to support Net Zero Building behavior change through tenant engagement. From social practice theory (Shove, 2010) to the latest behavior change insights (Laskey, 2013) using social norms, games, and incentives, to a psychosocial focus on underlying affective motivations, including loss, anxiety and security (Lertzman; Randall, 2009; Weintrobe, 2013), there are numerous frameworks and approaches competing for airtime. This is often a highly contested terrain, depending on our particular orientations and epistemic frameworks; some would argue for a focus on how our brains are wired, others would advocate for theories of change to address culture and social mobilization. While all share common goals -- supporting low-carbon behaviors -- the approaches and tactics can vary widely depending on our orientations. To address this, I first present an overview of the four dominant orientations used currently to tackle low-carbon behaviors -- behavior change 'tools,' values-based 'messaging,' systems innovation 'design,' and affective 'emotional engagement.' I argue that most of us tend to occupy one or two of these camps, when in fact a far more integrated approach is what is needed. In this presentation, I explore these 'orientations' to psychological dimensions of energy engagement and communications via the "Quadrant Approach to Engagement" (Lertzman, 2014). In so doing, I argue for the need for truly integrative approaches that recognize the contributions across all four quadrants - behavioural, socio-cultural, systems and psychosocial - in effectively meeting the challenges presented by climate science communications. In particular, I argue one area in particular, psychosocial thinking and research, and a concern with the role of affect and identity, represents a significant 'skills gap' and offers an as-yet under-represented, and under-utilized contribution that can potentially inform our practices and research insights. Contrary to common perceptions of being 'too theoretical' I argue that in fact incorporation of these dimensions can turbo charge our practices profoundly. I offer potential solutions towards more integrative approaches, including improving the skills gap through training in core psychodynamic concepts most germane to this work: namely how people response and handle anxieties, fears, and related psychodynamic processes such as defenses and denial. This presentation draws from research conducted for the Skoll Global Threats Fund, as well as a report for University College London and experience teaching environmental educators and communications professionals in a Master's program in BC.

3E: Frontiers in Research & Understanding of Behaviors

Moderator: Margaret Taylor, Stanford University

Speaker: KC McKanna, UCLA Luskin Center for Innovation

Explaining Anomalies in Energy Pricing Experiments: Policy Lessons from a Direct Cognition Model

As energy and water supplies become scarce and volatile, efficient demand side management is becoming increasingly critical. At the same time, the expansion of advanced metering infrastructure is now enabling utilities to adopt more sophisticated pricing schedules that disincentivize energy use that occurs during peak periods or exceeds essential use. However, the success of this policy strategy depends upon consumer sensitivity to price signals. Recent energy pricing experiments reveal that actual utility consumer behavior deviates significantly from economic predictions, often in surprising ways. For example, studies reveal that consumers exhibit startling heterogeneity in their knowledge of not just the energy prices they face, but also the quantity of energy they actually consume. Many of the consumers studied do not appear to respond to marginal costs although some may respond to average cost pricing. Yet, utilities experimenting with dynamic prices have shown that consumers respond to higher time variant electricity prices by conserving or shifting their energy use at significant rates. Even more puzzlingly, consumers facing declining rates may reduce usage in response to past price shocks or the introduction of a new pricing schedule . We critically review this growing literature on the consumer's knowledge of, and responsiveness to, energy prices with an eye to solutions to the dilemma of utility price insensitivity. We interpret these findings within a directed cognition model, which expressly recognizes consumers' cognitive resources as scarce resources that consumers allocate optimally when making energy consumption decisions. Within a directed cognition model, the marginal expected benefit to the consumer of allocating incremental cognition to a consumption decision is equal to their avoided expected utility loss from making an incorrect choice as a result of foregoing that incremental cognition in the choice process. A model of directed cognition yields clear predictions about the consumers' willingness to 1) attend to energy price and quantity information, 2) use that information to formulate an optimal flow of energy services for the choice occasion and 3) incur the costs of deploying an energy technology accordingly to achieve that optimal service flow. We derive lessons about the form and timing of price and quantity information, technology replacement policies, as well as policies influencing smart meter and residential energy management technologies.

3E: Frontiers in Research & Understanding of Behaviors

Moderator: Margaret Taylor, Stanford University

Speaker: Joseph Kantenbacher, UC Berkeley

Time Use and Its Implications for Energy and Climate

With good cause, substantial focus is given to behavior change programs that target social norms and networks, personal values, and financing. A relatively underappreciated lens for examining energy- and climate-relevant behavior at the household level is time use. All people must live on twenty-four hours of daily time, and with these twenty-four hours, we have to produce health, meaning, income, happiness, and myriad other internally and externally motivated outcomes. Time is our least renewable resource, and decisions about its use have substantial implications for environmental as well as personal well-being. This talk will highlight two connections between time use and energy consumption behavior: 1) the use of energy-consuming devices to save time and 2) the time rebound effect associated with energy efficiency programs. Looking specifically at non-work time in the United States, this study combines data from time-use diaries, consumer expenditure studies, and economic input-output tables to quantify the energy and carbon footprints of various discretionary activities (in units of MJ or g C per hour). These modeling results, in turn, are used to estimate how the time-use effects of energy and climate behavior change programs may blunt or enhance the success of those programs. Results suggest that, in some instances, efforts to redirect time use away from highly consumptive activities may be more effective than the more conventional promotion of energy efficient technology substitutions. Examining how people spend their time can be a useful means of selecting and prioritizing intervention projects.

3F: Leveraging Smart Meter Data to Identify Energy End Uses

Moderator: Eric Coffman, Montgomery County

Speaker: Anna Spurlock, Lawrence Berkeley National Laboratory

Using data to identify energy behaviors, actions, and characteristics of households

Currently, surveys are widely used to identify energy characteristics, actions and behaviors of households. However, surveys can be expensive to implement. In addition, surveys can be wrong: in a recent study (Allcott, 2014), around 50% of customers said that they purchased an Energy Star model, but in fact only around 5% had. This can lead to incorrect conclusions about actual behaviors of households. In contrast, using "big data" such as increasingly accessible hourly energy data from smart meters, combined with other readily available time and location specific data (e.g., census, weather, satellite), can provide a relatively cheap and easy way to gain insight into the actions that households are taking. We will provide examples of analytical methods that use easily these accessible data sources to identify specific energy behaviors, actions, and characteristics of households. Allcott, H. 2014. "Information Disclosure Through Agents: evidence from a field experiment." 19th Annual POWER Conference on Energy Research and Policy. Berkeley, California. March 21st, 2014.

3F: Leveraging Smart Meter Data to Identify Energy End Uses

Moderator: Eric Coffman, Montgomery County

Speaker: Tianzhen Hong, LBNL

Data Mining of Window Opening and Closing Behavior in Office Buildings

Occupant behavior is stochastic, complex, and multi-disciplinary. Studies have shown significant impact of occupant behaviour on energy use and environmental performance of both residential and commercial buildings. The understanding of the relationship between occupant behavior and building energy consumption can be seen as one of the most effective ways to bridge the gap between predicted and actual energy consumption in buildings. However effective methodologies to remove the effects of other variables on building energy consumption and isolate the leverage of the human factor precisely are still poor investigated. Moreover, the use of data mining approaches in finding meaningful correlations in a large data set is rarely discussed in existing literature. In a view of these facts, this study employs two data mining methods, cluster analysis and association rules, to discover patterns of windows opening and closing in a dataset with: (1) 5-minute interval data over two complete years, (2) 16 offices of a natural ventilated building, and (3) a dozen measured indoor and outdoor physical parameters as well as measured energy use. The windows opening/closing patterns consider diversity and presence of occupants, time of day and day of year, and important indoor and outdoor environmental parameters. The proposed data mining approaches, coupled with traditional statistical analyses, can be used to disaggregate occupant behaviour into clusters and to categorize typical drivers of behaviour in office buildings. Final goal is to identify valid, novel, potential useful and understandable patterns of occupant behaviour into measured building data. The identified windows opening/closing patterns will be represented as typical occupant profiles that can be used as input to current building energy modelling programs, like EnergyPlus and IDA-ICE, to investigate impact of windows opening and closing behaviour on energy use and design of natural ventilation in buildings.

3F: Leveraging Smart Meter Data to Identify Energy End Uses

Moderator: Eric Coffman, Montgomery County

Speaker: Michaelangelo Tabone, PhD Student

Leveraging AMI Data for Energy Efficiency and Conservation Research

Advanced metering infrastructure (AMI, or smart-meters) has the potential to offer insights into how, when, and why residences use energy. Such information is important for many reasons. 1, Energy efficiency and conservation programs are shifting from infrastructure upgrades to informational programs that are specifically targeted at changing consumers' energy use habits. 2, Predictions of the savings from energy efficiency upgrades are dependent on assumptions relating to in-situ efficiency and behavior, these predictions will benefit from more informative monitoring. And 3, the design of energy service technology affects behavior, and these behavior changes are often unmeasured and unstudied. Estimates of efficiency or behavioral properties of residence using AMI are useful for two main reasons. Due to the prevalence of AMI, any estimate for behavior or efficiency that can be made from AMI data can be made for a large, representative sample of residences throughout a utility's territory. Also, unlike surveys or interviews, inference from AMI data does not rely on consumers' awareness of their own energy use habits or their homes' infrastructures. Disaggregating useful information from AMI recorded data remains a difficult and unverified task. AMI typically records only total energy consumption over intervals of 15 minutes or 1 hour. While it may be possible to use pattern recognition techniques to identify large and persistent consumption from a few appliances (I.e., HVAC, pool pumps, and electric vehicles), characterizing the uncertainty in these estimates is difficult and models should be evaluated for potential biases in their estimates. In this paper, we evaluate a set of hidden state statistical models that identify behavioral and efficiency properties of residences using data recorded by AMI. Each model focuses on disaggregating HVAC energy use from the aggregate energy use signal. Hidden states are used to identify either (1) the set point of the thermostat and/or (2) consistent patterns in non-HVAC energy use (with no presupposed physical interpretation). Each model is capable of identifying one or more of the following properties: 1. Effective thermal resistance of the residence 2. Effective thermal capacity of the residence 3. HVAC energy use 4. Non-HVAC energy use 5. Thermostat set-point schedule 6.A non-HVAC appliance use schedule We use maximum likelihood and Bayesian fitting methods to evaluate the models for their computational efficiency of fitting as well as uncertainty in their estimates. We use a resolute dataset that contains information from communicating thermostats (internal temperature and set point) as well as sub-metered HVAC energy use to create a best-case unbiased estimate for each of the above parameters. We compare estimates from the AMI data to estimates from this more resolute dataset to evaluate bias in the hidden state models. We then propose an application of these models to a large set of AMI data from 3000 consumers in the Pacific Gas & Electric territory, covering 2 years. In which we identify consumers who have dramatically increased or reduced their energ use and offer am explanation of what behavioral or infrastructure changes may have caused this reduction.

3F: Leveraging Smart Meter Data to Identify Energy End Uses

Moderator: Eric Coffman, Montgomery County

Speaker: Pierrick Bouffaron, California Institute for Energy & Environment, University of California, Berkeley

Revealing Occupancy Diversity Factors in Buildings Using Sensor Data

The definition of the number of people that occupy a particular space and for what duration is difficult to characterize because human behavior is considered stochastic in nature. Occupants' locations within a building varies throughout the day and this distribution can be valuable information when evaluating demand control strategies. Occupancy diversity factors have not been studied as extensively as for example lighting and plug loads diversity factors. Some reasons for fewer studies of occupancy is limitations accessing existing occupancy datasets and challenges interpreting the data. In a research building at UC Berkeley, we were able to add sets of passive infrared (PIR) or motion sensing for occupancy and carbon dioxide sensors in 67 private offices and 2 conference rooms, as well as in multiple open offices. In this work we study deterministic and stochastic building occupancy models based on data from the deployed sets of sensors. Data is analyzed to show major variations of occupancy diversity factors in private offices and conference rooms for time of day, day of the week, holidays, and month of the year. The impact on the building electrical load is highlighted: people usually operate electric lights, computers, and other common office devices when in a space, and this equipment is often turned off or in sleep mode when the space is not occupied. The diversity factors presented in this study can differ as much as 40% from those published in the literature or in last ASHRAE energy cost method guidelines, a document commonly used by energy modelers for building simulations. This may result in misleading simulation results and may introduce inefficiencies in the systems design and control. Therefore we argue that building occupancy is a basic and key factor in energy simulations. Occupancy sensors can certainly help in calculating better diversity factors, but what is the optimum number and distribution of sensors to improve performance and justify the cost?

4A: Lightning: Program Design

Moderator: Marsha Walton, NYSERDA

Speaker: Scott Thach, Alliance to Save Energy

Recognizing Behavior Change as a Resource

Rising energy prices, tightening budgets, and a growing awareness of the need for sustainable energy practices have fueled historic growth in green energy. State and local governments, businesses and consumers are investing in efficient technologies and renewable energy sources; but often the lowest-hanging fruit—and the most consistent savings—come from low and no-cost behavior change. While quick hardware fixes are understandably attractive, comprehensive behavior programs can yield higher returns on than most capital upgrades. Still, states and regulators have been slow to recognize behavior change as a resource for meeting their energy efficiency goals. This presentation will share the experience of the Alliance to Save Energy's K-12 behavior programs in generating measurable energy savings, and provide a blueprint for substantiating the validity of behavior-based energy use reductions. Begun in 1996, the Alliance to Save Energy's PowerSave Schools Program was designed to educate students about energy efficiency, and empower them to translate that knowledge into school-wide, hands-on efficiency campaigns. The program has evolved to reflect best practices in program design and delivery. The result has been more than 15 years' worth of savings data—averaging 5-15%. The data has also helped to identify essential elements of behavior program design, and their impact on the size and persistence of energy savings. Identifying these elements can help establish an accepted framework for program design that leads to reliable, measurable energy savings. Equally important to establishing confidence in the efficacy of such programs is the validity and transparency of the energy tracking mechanisms. The program provides independent energy-savings measurement to provide timely feedback on efficiency efforts and help to shape schools' behavior campaigns. The Alliance provides a system of energy tracking—and corroborating metrics of conservation engagement—that has allowed districts to return millions of dollars of behavior-based savings to their participating schools. Again, developing rigorous standards for such tracking is essential to building support for behavior programs as a resource. The Alliance's experience, along with the quantifiable results of similar programs, creates a strong empirical basis for recognizing that just as behavior drives demand, behavior change can dramatically affect energy use.

4A: Lightning: Program Design

Moderator: Marsha Walton, NYSERDA

Speaker: Sheri Borrelli, UI/CLP

On the Fast Track to Reducing Energy Consumption: Creating Energy-Efficient Communities in Connecticut

Imagine 169 towns and cities committing to reducing their municipal and board of education buildings' energy consumption by 20 percent by 2018. Sound too far-fetched? It is in fact reality. Re-launched in 2012 to focus on, and include energy efficiency, Connecticut's Clean Energy Communities program is gaining tremendous momentum with over half of the state's 169 municipalities pledging to meet 20% energy reduction levels. Connecticut Light & Power and United Illuminating, as Energy Efficiency Fund administrators, provide the necessary tools to assist communities in realizing energy savings. Community tools provided include: assisting communities in gathering energy usage data, benchmarking buildings utilizing the U.S. EPA's Portfolio Manager Software and creating Municipal Action Plans (MAPs) on how to reduce communities' energy consumption. Once communities identify their "energy stars" and "energy hogs", they are guided through their MAPs to identify cost-effective, energy measures to meet the 20% reductions. Additionally, communities are incentivized to increase participation in residential and business energy-saving programs. Program administrators created a carrot called "Bright Idea Grants" to incentivize communities to participate in energy-efficiency programs. Every time a house, business or municipal building redeems a rebate or participates in an energy-saving program, they earn their community points. Once a community earns 100 points, a Bright Idea Grant ranging from $5,000 to $15,000 is granted. Grants can be used for energy-saving projects within the community. From paying for performance-grade energy audits for municipal buildings or leveraging existing incentives, communities have the flexibility to determine the grant expenditures to align with their MAPs. In addition, pilot "Energize Towns" to promote gas conversions and energy efficiency opportunities are developing and and creating a tremendous amount of opportunity. Sheri and Rebecca will discuss how the towns have been selected, why, what marketing techniques were used, and what success we have seen.

4A: Lightning: Program Design

Moderator: Marsha Walton, NYSERDA

Speaker: Ann Arney, CLASS 5 Energy & Schools for Energy Efficiency

Reducing Energy in K-12: Combining Performance Contracts with Behavior

Many school districts view energy as an escalating, uncontrollable cost. In reality, energy use can be controlled in two ways: by acquiring new, more efficient systems and technology or by changing the behavior of the people in the building. The smartest districts do both. Including behavior as part of a performance contract allows a district to capture energy saving opportunities outside of the proposed asset upgrades. In addition, behavior programs help to create a culture of energy conservation so that when construction is completed and the new systems and equipment are up and running, people across the district are aware and empowered to do their part to ensure energy savings are maintained and/or increased. By implementing CLASS 5's Schools for Energy Efficiency Program, a school district can further reduce its energy use and costs by 5-10% above the energy costs avoided as a result of a performance contract. The calculated savings are measured in energy reductions and costs avoided beyond the energy conservation measure estimates provided by equipment retrofits. In 2012, CLASS 5 Energy established partnerships with several Trane offices across the U.S. to work together to help school districts achieve even greater energy savings. In March 2014, Kansas City Public Schools approved a $38 million performance contract with Trane that included CLASS 5's Schools for Energy Efficiency (SEE) program. Beyond the tangible, behavior-based energy savings that are guaranteed as part of the performance contract, the district recognized that SEE provided additional benefits: educating and engaging a future generation of energy consumers; creating a district-wide shared value around energy conservation; and sending a message to the Kansas City community that the district values their investment, just to name a few. This presentation will outline how a behavior program fits into a traditional performance contract; the design of the partnership between Trane and CLASS 5 Energy; and will include a case study of Kansas City Public Schools (KCPS), who are currently implementing a Trane performance + CLASS 5 behavior contract. In the case study we will highlight: • The KCPS EEC, their role and daily job functions • The SEE Program, what it is, what is included • How SEE (behavior) fits with Trane (performance contract) in KCPS • Measurement of, and how to determine, t he behavioral impact on energy within this type of partnership • KCPS results to date

4A: Lightning: Program Design

Moderator: Marsha Walton, NYSERDA

Speaker: Tom Syring, Franklin Energy Services

Integrating Behavioral Concepts into Existing Energy Efficiency Programs

Behavioral energy efficiency programs have expanded dramatically over the past several years. Many program administrators are adding behavioral programs to their efficiency portfolios, but others stop short of adding entirely new programs because of the tremendous commitment of time and resources to get started. A middle ground exists between adding new programs and taking no action on the behavioral front. Many concepts or triggers for behavioral change can be integrated into existing programming with ease and at little or no additional cost. This presentation will outline five such concepts that show promise for increasing savings from existing programming. Additionally, overviews of two completed pilot programs will be presented in detail. The first pilot integrated the concept of loss aversion - people react more strongly to messages of loss than to messages of potential gain. The second pilot integrated the concept of choice overload – people often take no action when faced with a long list of potential actions, which may prevent them from acting on energy efficiency recommendations. Both pilots attempted to increase savings following the completion of an on-site energy assessments at a variety of small businesses. While the results were mixed, both of these pilots demonstrate a model for integrating behavioral concepts into existing programs utilizing a randomized field experiment design.

4A: Lightning: Program Design

Moderator: Marsha Walton, NYSERDA

Speaker: Agapi Papadamou, DNV GL

Know What Buttons to Push: Key Behavioral Change Learnings for Energy Efficiency Programs

The design and implementation of effective programs to engage customers and motivate changes in energy consumption behavior is particularly relevant as behavioral programs promoting energy efficiency gain prominence world-wide. Savings estimates reported by programs have ranged from 1% to 12% and these behavior programs represent a cost-effective way for utilities to meet their energy efficiency goals. While utilities all over the world have gained insights and learned lessons through the deployment of energy efficiency and smart grid programs, growing customer expectations and continuously evolving customer behavior and engagement, necessitate tailored approaches for a dynamic market. This presentation will showcase findings from research that was conducted as part of the first phase of a study on behalf of the Scottish and Southern Power Distribution (SEPD), Solent Achieving Value from Efficiency (SAVE) pilot project in the UK. This project will robustly trial and establish the extent to which energy efficiency can be considered as a cost effective, predictable and sustainable tool for managing peak demand as an alternative to network reinforcement. In order to effectively design and implement the trials and acquire a useful learning that can be applied in the SAVE project, an international review of best practices on residential customer engagement approaches has been carried out, assessing their relative success and especially understanding the reasons why they were successful or not, as well as the challenges faced and how they were overcome. The review spans diverse geographies (USA, Europe and Australia) and, hence, multiple cultures, climate conditions, and regulations. More than 30 reports/projects and 10 case studies of ongoing programs around the world are assessed and presented under the '6Es Framework' produced by the UK Cabinet Office, which provides a guideline for policies that aim to change behavior and promote energy efficiency. The 6Es refer to the actions needed to be taken by the body that implements a policy and are: Explore, Enable, Encourage, Engage, Exemplify and Evaluate. To best select and categorise the effects, a list of the nine most robust influences on human behavior is being used as a checklist. This list, which was developed as part of the '6Es Framework', is named MINDSPACE after the initials of the different influences: Messenger, Incentives, Norms, Defaults, Salience, Priming, Affect, Commitments, Ego. The extensive literature review and primary field research of relevant projects reveals that influencing behavior is achieved through different ways and with different levels of success. While some of the influences on human behavior are deployed as levers in several programs, some others are used less often. The authors found that the first three elements of MINDSPACE, Messenger, Incentives and Norms, seemed to be the most frequently used to influence behavior in the energy efficiency context, with the remaining ones playing a supplementary role. This presentation will highlight untapped elements that could have implications for alternate program design and also share key behavioral change learnings that will inform the design and deployment of the trials during the SAVE pilot project.

4A: Lightning: Program Design

Moderator: Marsha Walton, NYSERDA

Speaker: Sarah Castor, Energy Trust of Oregon

Delivering More Savings: A Custom Approach to Improving Energy Saver Kits

Organization X has been delivering kits of energy saving devices to residential utility customers since 2008. Kits provide an important customer service to households, including harder-to-serve renters, while delivering reliable energy savings to meet program goals. They can also serve as a gateway to larger energy saving home improvements. Prior to 2013, all kits Organization X delivered contained a fixed number of standard CFLs, a showerhead, kitchen faucet aerator and bath faucet aerator. However, surveys of kit recipients in 2012 showed that only about half of CFLs and showerheads and a quarter of aerators were being installed. Many customers didn't even recall receiving the showerheads and aerators, presumably because they ordered the kit to get the CFLs and weren't as interested in the other devices. Beginning in 2013, Organization X moved from "static" kits to custom "build your own" kits. Custom kits contain a variable number of lightbulbs, aerators and showerheads depending on house characteristics and customer preferences. For example, a customer with two bathrooms in their home could receive two showerheads, or could elect to only receive one showerhead (or none) if they choose. This change was hypothesized to increase the installation rates of devices received. Custom kits also allow for the inclusion of specialty CFLs, including A-lamp, globe, reflector and candelabra bulbs, based on the types of fixtures a customer reports in their homes. These bulbs would have been difficult to offer in a static kit, based on their limited applicability in many homes. A 2013 survey of custom kit recipients reveals that the "build your own" approach to kits has increased the installation rates of some, but not all, devices. Showerheads and bath aerators are now installed much more frequently, but the installation rates for kitchen aerators remains about the same. The change in installation rate for standard CFLs is difficult to interpret because the 2012 survey relied on customers to recall the number of CFLs received and two thirds recalled an incorrect number, making it difficult to establish the baseline installation rate. This was an important finding and led to improved methods for the 2013 survey. The paper and/or presentation will discuss changes in installation rates, energy savings and cost impacts from moving to custom kits, as well as customer satisfaction and feedback about the kits and devices, reasons for not installing devices, and energy saving actions recipients report taking as a result of the kits. We will also discuss the requirements for implementing custom kits and the role of kits in a healthy residential retrofit program.

4A: Lightning: Program Design

Moderator: Marsha Walton, NYSERDA

Speaker: Erin Claybaugh, Lawrence Berkeley National Laboratory

Remember the Human Connection

For years, the waste diversion rate at Berkeley Lab hovered around 45%, which was just short of our federal goal of 50% waste diversion and well below our UC-system goal of 75% waste diversion. When a newly renovated building was occupied without any recycling or composting, we seized the opportunity to design a new waste diversion program with the input of all stakeholders – occupants, custodians, contract officers, and sustainability professionals. The new program was a success in that first building with a waste diversion rate exceeding 72%. We interpreted the success as a demonstration that clear infrastructure, persuasive communication, and various feedback mechanisms were sufficient to assist our occupants, who are familiar with recycling and composting programs in their homes. However, expanding the same program to 8 more buildings using the same implementation method resulted in mixed success. Depending on the building, waste diversion rates improved by 5-25% from baseline measurements for each building. Each phase of the waste diversion program – design, implementation, and maintenance – taught us valuable lessons to help us apply and adapt conventional behavior change techniques. Prioritizing human connection became our most reliable strategy to change behavior and continuously improve the program.

4A: Lightning: Program Design

Moderator: Marsha Walton, NYSERDA

Speaker: Rodrigo Holtermann Lagreca, Evolva Projetos

Behavioral Programs in Brazilian Utilities: Paving the Way for New Prospects

In Brazil, energy efficiency programs involving approach to behavior change are a field to be explored. The big part of actions aimed to that purpose are developed in schools, and there are consensus among local experts they lack of better evaluation methodologies, as well as a better support and continuity to the treated population. So, in Minas Gerais State (a developed region in the Southeast of the country) the local utility decided to test a program which could bring together the best experiences from regular energy efficiency programs with the state of art techniques for engaging people to change their consumption habits and behaviors. In this context, we implemented an experimental program for 500 families in Sete Lagoas city, which included some key aspects, such visits with month frequency, community engagement, multiple local actors articulation, program publicizing and real time feedback, using an IT solution. As the program was being implemented, the management team could realize its full importance, once the context of the market and the dynamic if its driving forces weren't clear enough when the action was designed. Brazilian energy market is experiencing strong rising, mainly in households, and among them, low income dwellings are even stronger. This is happening due a sort of reasons, and the economic rising of this social class is among the main ones. This fast growing scenario drives together to an increase waste of energy, thus treating population consumption habits is becoming an issue, which is getting more important. In the evaluation phase, we could divide the outcomes in two groups: the direct savings obtained from the experience and the learning built for paving the way for new energy efficiency programs related. The direct savings were in order of 13% in a one year course, which is far above of the gains obtained from traditional energy efficiency programs (based on change of light bulbs and fridges) – around 4% - and also better than savings obtained from programs addressed to schools. Another related outcome is the awareness increasing for environmental issues, not only energy, but also water conservation and correct waste disposal. Regarding leanings produced for another energy efficiency programs for Brazilian utilities, this experience concluded that future energy efficiency programs can achieve better results as long as they are able to keep connected and linked with the treated population. This capability, brought together with regular actions already used (so in households as the ones applied to schools) can drive to a new prospect for investments in energy efficiency programs.

4A: Lightning: Program Design

Moderator: Marsha Walton, NYSERDA

Speaker: Neel Gulhar, Opower

The Missing Variable in the AMI Value Equation: Customer Value

Utilities and countries around the world have installed or have plans to install Smart Meters across entire service territories. To date, AMI deployments have primarily been managed as technology and operational projects without focusing on customer benefits and consumer engagement. As such, some utilities are failing to realize the full value of their investment. Regulators around the world are now asking the question, "How will customers benefit from the sizable AMI investment?" To ensure that customers receive and understand the value of the utility's investment, two actions are required: 1.) invest in tools that leverage the AMI interval data to deliver personalized, timely and proactive insights to consumers and 2.) educate customers on the value of Smart Meters and the benefits that they will receive from the investment. Many leading utilities have created value for their customers as part of their Smart Meter deployments. We can learn from these early examples as the rest of the industry seeks to capture the full benefits of Smart Meters. This study will highlight AMI deployments from around the world and an emerging requirement to deliver customer value as a key business outcome of AMI investments. Additionally, the presentation will also include case studies of utilities that have successfully delivered such value for their customers.

4B: Latest in How to Communicate About Climate Change

Moderator: Maxine Savitz, Honeywell Inc. (ret.)

Speaker: Jorge Madrid, Environmental Defense Fund

Mapping Climate Risk and Opportunity

President Obama recently announced the Climate Data Initiative, a call to action to leverage "Big Data" in order to stimulate innovation and entrepreneurship in support of national climate preparedness. In Los Angeles, the Environmental Defense Fund and UCLA Luskin Center for Innovation have answered the call and introduced "Los Angeles Solar and Efficiency Report (LASER)," a breakthrough climate mapping tool designed to help local leaders identify opportunities to invest in clean energy jobs and strengthen climate resiliency in vulnerable communities. Using multiple climate models and other public data, LASER maps illustrate what climate change is going to look like in the Los Angeles region in just a few decades, with a special focus on the impacts to the 36% of Los Angeles County residents (3.6 million people) living in environmentally vulnerable communities already burdened by air pollution and other environmental hazards. The study also finds nearly half of the state's most vulnerable population lives in LA County. The LASER maps also introduce a powerful narrative about how we can fight back by mitigating the carbon pollution driving climate change, building community resiliency through investments in energy efficiency and renewable energy, and seizing opportunities for economic growth that reduce vulnerability. The study also concludes: • Nearly 29,000 local jobs in solar panel installation could be created if merely 5 percent of the rooftop solar energy generating potential in LA County was realized. • Capturing this 5 percent of solar capacity would reduce carbon dioxide emissions by 1.25 million tons annually, equivalent to taking 250,000 cars off the road. To mitigate the worst effects of climate change, and prepare vulnerable communities for the climate impacts already on their way, we need serious investment and deployment of clean energy and low-carbon infrastructure – particularly in those communities that will be hit the hardest. LASER provides tools that can help elected officials and advocates pinpoint the communities that are most vulnerable to climate change, identify the region's clean energy investment potential, and then develop policies and funding mechanism to unleash it. The presentation will illustrate the power of big data and visual mapping tools to tell a story of threat and opportunity, particularly in vulnerable communities, and present ideas for other regions to replicate and modify this tool for deploying clean energy and low carbon infrastructure.

4B: Latest in How to Communicate About Climate Change

Moderator: Maxine Savitz, Honeywell Inc. (ret.)

Speaker: Meredith Herr, Climate Access

Amplifying Solutions Stories: Climate Outreach Strategies that Inspire Hope

Given the magnitude of climate impacts and the global challenges they present, it can be easy to focus on the problem of climate disruption without offering realistic alternatives. Highlighting near-term, local impacts and tying them to concrete solutions helps make climate disruption more relevant to audiences and increases their motivation to take action. It is time for climate communicators to replace doom-and-gloom messages with stories of the low-carbon solutions that are already in progress across the country. Even individuals who are most concerned about climate disruption can find it hard to imagine a low-carbon world, as political leaders largely seem unwilling or unable to pass effective legislation and industry continues to push the sense that fossil fuels are an inevitable part of our energy future. What can climate leaders do to combat such fatalism? How ready is the public for viable solutions? What are some messages and ideas that appear to provide the best sense of hope? The Climate Access team has analyzed social science literature, public opinion research, media coverage, and case studies to better understand how to frame climate and clean energy solutions in a way that builds support for action. Meredith Herr, Director of Research and Content at Climate Access will share findings from this analysis, including examples of success stories from the field. Meredith will also provide recommendations tailored specifically for climate leaders who are looking to develop messages and outreach strategies that illustrate how low-carbon solutions are achievable and beneficial for local communities.

4B: Latest in How to Communicate About Climate Change

Moderator: Maxine Savitz, Honeywell Inc. (ret.)

Speaker: Meighen Speiser, ecoAmerica

This Time It's Personal: Compelling Climate Communication from Reality to Solutions

No longer a distant, abstract theory, climate change has arrived in America. Americans are noticing the change, and many are concerned, however climate change remains at the bottom of the list of public policy priorities. In fact, it remains at the bottom of the list of American's personal priorities, too. From a policy perspective, climate change is surpassed by priorities such as healthcare, national security, and economic progress. Personally, Americans are much more concerned about their families' wellbeing, career advancement, and personal prosperity than they are about doing anything about climate change. In order to reach a tipping point of public support for climate and energy solutions and lead America toward a clean energy future, stakeholders must connect with mainstream Americans with compelling communications that unearth the connections between climate solutions and their personal priorities. This begins with deeply understanding how Americans think, feel and react to climate and energy issues. In this session, ecoAmerica's Chief Engagement Officer, Meighen Speiser, will share findings, implications, and recommendations for creating compelling communications on climate solutions based on extensive social science research across a breadth of disciplines. This presentation will cover both the facts – how Americans think and feel about climate and energy – as well as guidance for those who seek to communicate and engage with Americans about climate and energy solutions. ecoAmerica, a research-driven nonprofit working to build mainstream support for climate solutions, has conducted research across a range of disciplines on Americans' climate and environmental attitudes and values. This year, ecoAmerica produced four major research reports: one focused on psychographic insights, another on psychology, another on communications methodology, and, lastly, a comprehensive study on communications frames and messages. ecoAmerica's psychographic research, American Climate Values 2014, in collaboration with Strategic Business Insights, used an innovative methodology that allows for the generation of deep insights about the most fruitful approaches for building support for climate and energy solutions. Their psychology research studied how climate change impacts are affecting the mental health of Americans, and offered recommendations for how to support Americans individually and on a community level. ecoAmerica partnered with Columbia University's CRED to update their notable communications guide, with a new focus on climate impacts (reality vs. science). ecoAmerica also conducted communications research in collaboration with Lake Research Partners. This research used rigorous methodology, from focus groups to dial testing to surveys, to uncover frames and messages about climate and energy that resonate with a broad range of the mainstream American public. Findings and recommendations will be shared from each of the four studies.

4C: Reaching Low Income and Underserved Communities 1

Moderator: Lauren Ross, ACEEE

Speaker: Carol Edwards, Southern California Edison

Beyond Traditional Methods to Understand Customer's Willingness to Participate

California's Public Utilities Commission (CPUC) and the investor-owned utilities (IOUs) including Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), San Diego Gas and Electric Company (SDG&E) and Southern California Gas Company (SCG) recently completed a study to learn more about the energy-related needs of California's low income customers and how the Energy Savings Assistance (ESA) and the California Alternate Rates for Energy (CARE) programs may better address the needs of this population. The Needs Assessment study included numerous research objectives and not surprisingly, employed multiple methods to collect data to answer the myriad of research questions that supported these objectives. One of the key objectives involved understanding how many of the remaining eligible customers in the state are willing to participate in the ESA program if given the opportunity. This is a critical piece of information for program planning as it informs target participation or customer treatment goals for the utilities. Often simple questions are asked of customers to ascertain their interest in participating in a program. Unfortunately, customers' responses to such questions may not always reflect actual participation uptake since the "other factors" including what is actually required for participation or "real life" deterrents to participation are generally not folded into a customer's response on a quick survey. In this presentation, we will illustrate the benefits of triangulation and how this study used multiple methods, data sources, analytical approaches and innovative techniques including the application of survey non response bias methods (or correction factors) to provide a potentially more accurate and reliable assessment of "willingness to participate" in California's Energy Savings Assistance program. The methods included obtaining the perspectives of low income customers using both phone surveys and in-home interviews in which customers were provided descriptions of program participation requirements and benefits. The data collected via these methods were further examined in the context of non-response bias, since the program outreach approaches are similar to those used for soliciting customers to participate in research. This allowed for potentially more realistic final estimates of willingness to participate that factored in customers who may not be inclined to respond to either program or survey solicitations for participation. In addition, to address the limitation of the customer sampling, the researchers obtained data on the state's low income population using the IOUs', Census and other secondary sources to develop propensity models for the program to predict participation and inform the barriers to and drivers of participation. Taken together, these data offered a potentially more reliable and reasonable estimate of how willing customers would be to participate in the program. The presentation will also compare results of this multi-pronged approach to the results of a prior effort that utilized a more simplistic commonly used measurement approach to this type of research question.

4C: Reaching Low Income and Underserved Communities 1

Moderator: Lauren Ross, ACEEE

Speaker: Myriam Tourneux, Fuel Fund of Maryland

Addressing the Affordability Gap through Behavior Change and Education

Unfortunately, those who can afford the least are too often paying the most when it comes to home energy. In Maryland, households earning below 50% of the poverty line pay as much as 80% of their income in energy costs. Some government programs are available to assist families who struggle to afford their utility bills, but the assistance only covers about 30% of the need. Since 1981, the Fuel Fund of Maryland has been keeping families warm in the winter and cool in the summer by helping them pay a portion of their energy bills when they are in crisis. The decrease in available assistance dollars and the increase in energy costs led the Fuel Fund to address the affordability gap by lowering energy use. In 2008, the Watt Watchers of Maryland program was born to empower low-income consumers to reduce their energy bill as well as their risk of losing power or facing foreclosure. There are two primary groups of audiences for this program. The first is Fuel Fund of Maryland bill assistance clients. In 2013, the Fuel Fund provided assistance to 7,007 low-income families throughout central Maryland. This number is projected to increase to about 9,000 in the current fiscal year and more in subsequent years. The second is limited-income customers served by a large network of other nonprofit organizations we partner with (e.g. community action agencies, family centers. learning centers). Since July 2013, we have expanded and redesigned Watt Watchers. The end goals of the program are to empower communities and households to reduce their energy bills through long lasting behavior change, and establish a new social norm for saving energy. The new Watt Watchers initiative includes 4 programs: • Classes at community centers throughout central Maryland. Through group learning methods and games, participants discover fun and free ways to save energy and make energy conservation a fun and rewarding family experience. • An online version of the course. By early fall 2014, parents without childcare, people with disabilities, elderly individuals unable to travel, and many others will all have access to our program. • A community based energy savings program. Community leaders will be trained to facilitate energy savings workshops and to build a cadre of advocates who encourage their neighbors to save energy and share important learning beyond initial Watt Watchers contact. • An Energy Advisor program. All Watt Watchers graduates receive free and personalized follow-up calls to help them implement what they learned and achieve the energy savings goals they set for themselves. During our presentation we will share and discuss: • Obstacles and challenges specific to programs targeting limited income customers and solutions we have found effective. • Fuel Fund is partnering with the E2e project and University of Maryland to measure the result of this initiative through a randomized controlled trial. We'll discuss how the results will inform future programming and encourage future support.

4C: Reaching Low Income and Underserved Communities 1

Moderator: Lauren Ross, ACEEE

Speaker: Jacqueline Berger, APPRISE

Energy Education in the Home

Low-income energy efficiency programs often have procedures for intensive in-home education as part of comprehensive no-cost weatherization service delivery. Detailed guidelines for education delivery may include the following elements. • Discussion of home comfort and other energy issues • Review of energy bills • Home walk through to identify and explain savings opportunities • Discussion of potential actions for energy usage reduction • Agreement on a plan of energy-saving actions for the occupant to take These can be costly investments, adding to the amount of time spent in the home and the paperwork that contractors must complete. While many programs make these investments, there has been little evidence to support the impact of this work. It is difficult to estimate the incremental impacts of education, because customers usually receive an assortment of measures that have varying impacts on usage. Therefore, the questions remain: • Are the defined procedures actually implemented in the field? • Even if procedures are implemented, do the participants remember and act on the information? • Does this work translate into reductions in energy usage? This research will answer these questions by providing linked evidence from several recent evaluation activities as part of two comprehensive low-income energy efficiency program evaluations. • Are the in-home education procedures implemented by contractors? On-site observation of service delivery by several different contractors in one program showed that some contractors do implement these procedures. The observations documented that the quality and amount of education that was provided did vary by contractor. We found that one of the contractors was most likely to explain the program, the partnership, and the auditor and client's responsibilities. A second contractor was most likely to discuss actions to reduce usage, thermostat settings, and energy saving cooling practices, and summarize actions with potential to save energy at the end of the visit. • Do customers internalize and act on this information? The customer survey found that customers of the contractor that provided the most comprehensive and educational introduction to the visit were most likely to report that the provider reviewed the energy bills. Customers of the two contractors that provided the most education were most likely to report that the provider furnished a plan for energy savings, and these customers were also more likely to report that they reduced their heating, hot water, and air conditioning usage. • Does the education translate into energy savings? The usage impact analysis showed that the contractor with the most comprehensive education as observed in the field and reported by customers had the greatest savings in two aspects of the program and the other contractor that was most likely to discuss energy saving actions as observed in the field and reported by customers had the greatest savings in another aspect of the program. These findings provide evidence that in-home education can be implemented effectively, impact customer behavior, and reduce energy usage. However, program managers need to ensure that the procedures are consistently implemented to achieve these results.

4C: Reaching Low Income and Underserved Communities 1

Moderator: Lauren Ross, ACEEE

Speaker: Rosa Y. Ortiz, Enterprise Community Partners

CNEC - Resident Engagement Competition

The Chicago Neighborhood Energy Challenge puts the power of reducing energy use and saving money into the hands of Chicago's families. CNEC is a six-month pilot competition among apartment buildings in Humboldt Park and Logan Square that engages residents in simple steps they can take to reduce their electric, gas, and water usage. This results in lower utility bills for families and property owners and a smaller carbon footprint. This competition is a key initiative by the City of Chicago to support the goal of making it the most sustainable city in the 21st century. Learnings from this pilot competition are being used to inform future competitions in Chicago and across the country. The presentation includes a short overview of the structure of the competition, energy savings data and valuable lessons learned for resident engagement. Additional background The Chicago office of Enterprise Community Partners (Enterprise) is the lead facilitator and manager for this competition. Enterprise is a 30 year-old not-for-profit organization that promotes a holistic way of addressing the design, construction, and operations phases of affordable housing development. Resident education has always been a key component for Enterprise as it enables residents to fully realize the environmental, health, and economic benefits that green housing offers. The competition launched in November of 2014 and will run until April of 2014. This six-month competition involves seven properties, 14 buildings, 503 units and over 750 residents. The properties range in size and type as well as year built. The participants include individuals, couples, families and seniors with the majority of the residents being Latino or African American. The program has been design to be culturally relevant and dual-language. The initiative began with a research component which helped identify key linkages specific for seniors and multi-family residents to sustainability and energy conservation. Once the research component was completed, the team engaged in the design and implementation of the competition and its materials. These included workshops, monthly workbooks, an interactive website and incentives delivered over the six months. The workshops were facilitated as dual language sessions on a monthly basis at each of the properties for residents and property managers. The workbooks and cheat sheets were tailored to be culturally relevant and to guide the residents in a variety of simple yet efficient energy saving activities. Resident Green Leaders at each property were identified and lead the education efforts door-to-door and floor-to-floor. The website is the tool for posting the energy savings and rankings for each person and building. The competition is nearing completion and in total more than $40,000 in prizes will be awarded to drive reductions in resident energy usage. With the first three months of data processed, each property has reduced their energy use in at least one of the three targeted areas (electricity, gas, and water). Data per property and sector has been tracked and analyzed and these along with key lessons and best practices for owners, property managers and residents will be featured in the presentation.

4D: Benefits to Self vs Others--Which Motives More?

Moderator: Danilo Pelletiere, HUD

Speaker: Renee Bator, SUNY Plattsburgh

Using social norms, feedback and intrinsic priming to achieve energy savings in non-metered multi-family housing

Abstract: Energy conservation can be difficult to promote in situations where individuals do not receive feedback through energy bills. Even those individuals who receive such feedback are often unaware of which behaviors result in the highest levels of consumption or financial savings. Additionally, people often mistake vivid behaviors, such as turning off the lights, to be linked to the highest levels of conservation. In this randomized field experiment, several treatment conditions were evaluated to determine their effectiveness at influencing tenants in large multi-family housing to reduce their summer electricity use. Participants in this experiment did not currently pay individual electricity bills or receive any financial incentives for conserving energy. The pilot design included 700 households that were randomly assigned to one of the six treatment conditions or to a no treatment control group. Treatment conditions included feedback on ambient room temperature and household electricity usage (particularly air conditioning), household electricity usage compared to neighbors' usage, and intrinsic priming to activate feelings of shared community, social equality, and bigger-than-self problems. A number studies have successfully used feedback and social norms to promote energy conservation (Bekker et al, 2010; Brandon & Lewis, 1999; Schultz et al, 2007). In addition to the normative feedback approach, the present study also builds on exploratory work reported by Chilton et al. (2012). Their work shows that engaging even people with high extrinsic-oriented values (expressed by concern with popularity, material success, personal achievement) to reflect on their intrinsic values related to social equality and justice, will make them more likely to express concerns about bigger-than-self problems and to feel responsible to unrelated others.

4D: Benefits to Self vs Others--Which Motives More?

Moderator: Danilo Pelletiere, HUD

Speaker: Sally Geislar, University of California, Irvine

Food Scraps, Households, and Climate Change: Exploring New and Old Habits

Diverting food and yard waste from landfills can eliminate a quarter of the nation's methane emissions, reduce our dependence on landfills, and contribute to clean energy production and soil remediation. While easy-to use physical infrastructure such as curbside bins is necessary, I argue that successful source-separated organics (SSO) programs rely on the everyday behavior of households. By extending socio-psychological approaches promoting pro-environmental behavior in energy conservation and recycling to SSO programs, I hope to inform larger zero waste efforts on campuses and in cities across the nation.

As organic material decomposes in the anaerobic conditions of landfills it generates methane, a potent greenhouse gas (GHG); in fact, landfills account for 25% of all methane emissions in the U.S. Significant and immediate opportunities for GHG reductions can be achieved through SSO programs that divert organic waste from landfills to higher uses. Existing SSO programs have revealed the need to do more than provide physical infrastructure ; even with San Francisco's highly successful three bin system, the city's Department of the Environment recently estimated that half of what still goes in the landfill bin could be recycled or composted. Universities across the country are striving to reduce their environmental impact through energy and water conservation, LEED certified buildings, and now through sustainable waste management. While dining halls and food services have been targeted for food scrap separation on some campuses, this is the first that I know of to address on-campus, apartment-style housing communities. Together with the Solid Waste and Recycling Manager at the University of California, Irvine (UCI) and the Verano Housing Associate Director of Operations, I have organized a pilot project for the first food scrap separation program in graduate student apartment communities at UCI. I will examine the role of norm communication and group commitment in improving household participation in SSO programs. By providing both the physical infrastructure, like separate bins and weekly collection, coupled with the social infrastructure like norm communication and group commitment, zero waste goals will be better attained. This research engages in a mixed-methods approach to understand two driving research questions. First, can theories of pro-environmental behavior change mechanisms be extended to food scrap separation? And second, what can we learn about the experience of SSO program implementation from participants? I will present results from a pretest-posttest quasi-experimental design measuring changes in food scrap separation behavior, perceptions, and attitudes of participants overtime. I will also present the results of self-report and objective data on the weekly separation behavior of households using digital surveys and community drop bin assessments. Finally, I will present qualitative results from two small focus groups and several one-on-one interviews with participants to understand their experience with this program and their households' food scrap disposal. I anticipate the findings will be of particular interest to SSO program managers dealing with multi-family housing, renters, young populations, and campus communities. By applying what we know about behavior change to SSO programs, we can achieve immediate reductions in GHG emissions and anthropogenic Climate Change.

4D: Benefits to Self vs Others--Which Motives More?

Moderator: Danilo Pelletiere, HUD

Speaker: Christa McDermott, Pacific Northwest National Laboratory

What is the real prize? A study of energy efficiency award winners in the federal government

Guidance for programs to promote energy efficient behavior often recommend giving awards for changed behaviors that achieve energy savings. But some recent research suggests that awards may motivate one-time or one-period achievements but do not necessarily lead to persistent change. We surveyed award winners from the Department of Energy's Federal Energy Management Program (US DOE FEMP) to assess the value of awards programs in changing behavior, such as those associated with designing buildings, contracting, and transportation. We focused on behaviors that could promote institutional change in an agency or office, that is making energy efficiency the default in the organization, rather than the exception. Award winners identified institutional facilitators and barriers in their projects and programs as well as factors in their implementation processes, thus providing information that can guide other efforts. We found that award winners do use strategies based on eight principles of institutional change, most frequently in terms of making changes to infrastructure, engaging leadership, and capitalizing on multiple motivations for making an energy efficiency improvement. The principles drawn on the least often were commitment and social empowerment. Award winners also faced five major types of obstacles that were institutional in nature: lack of resources, constraints of rules, psychological barriers, lack of information, and communication problems. Our findings also indicate that award winners are not necessarily motivated by the thought of winning; in fact, many of the winners either had not heard about the awards program or did not decide to apply for an award until after their institutional change goals had been achieved. The value of awards likely lies more in what the organization does after the awards are given: communicating successes and lessons learned to others as well as developing communities of practice. These results can help federal managers and others who run awards programs design more effective awards programs that will, instead of terminating with an awards ceremony, become the basis for future dissemination of "bright spots" and fostering institutional change to achieve persistent energy savings. Award winners' use of strategies that address human and organizational behavior to create successful projects and overcome obstacles demonstrate the importance of behavior and institutional change in reducing energy use. Explicit attention to institutional change factors helps both to increase the potential for successful energy efficiency efforts and improve the prospects for lasting changes. Based on these results, we make recommendations about dissemination of successful strategies, such as making winning strategies known and by creating capability through development of knowledge-sharing groups.

4E:Using Bid Data for Evaluation

Moderator: Abigail Daken, EPA

Speaker: Johna Roth, TecMarket Works

Smart Energy Now Pilot (SEN): Evaluation of a Large Scale Commercial Building Behavior Change Program

This paper will describe the Smart Energy Now program and present the process evaluation findings from the evaluation of the world's largest commercial sector behavior change program. The program was piloted by the largest utility company in the United States (Duke Energy) and evaluated by TecMarket Works and Yinsight. The paper will also present and discuss the challenges of the evaluation and the methodological approaches employed for overcoming those challenges. SEN and its diverse array of behavioral change campaigns were targeted to building owners, facility managers, tenant companies, and office workers. The program targeted mid-sized buildings to large skyscrapers, encompassing the entire Uptown Charlotte, NC area. Launched in 2010 in association with the Clinton Global Initiative, the Smart Energy Now (SEN) pilot is a first-of-its-kind program, employing new real-time digital grid technologies that are linked with new communications and monitoring strategies to drive behavior changes in commercial buildings in a metropolitan area. One of the biggest and unprecedented successes came in obtaining the support and agreement of over 60 high rise office buildings to allow their real time building energy usage to be displayed on touch screen kiosks installed in each building's lobby. These kiosks also conveyed motivational energy management messages and strategies. The process evaluation examined and assessed the effectiveness of the approaches used, including the motivational value of providing real-time building energy usage to the building occupants and to the facility managers. The impact evaluation methodology and its challenges will also be presented, providing a full view of the program. As a large, first-of-its-kind pilot program, standard evaluation methods were challenged by the need to distinguish program messaging effects from messaging from a multitude of other sources. Utilities interested in offering behavioral programs targeting the commercial sector can learn what program data should be tracked to 1) maximize attribution of energy savings to a specific program and 2) show the full value of this program on the wider business community.

4E:Using Bid Data for Evaluation

Moderator: Abigail Daken, EPA

Speaker: Dan Rubado, Energy Trust of Oregon

Just How Smart: A look at Energy Trust of Oregon Nest Thermostat Pilot Program

NEEA's 2005 analysis of heat pump performance has shown that many residential HVAC contractors do not install proper heat pump controls (or do not set the controls properly) to switch from heat pump to backup resistance heat at the appropriate temperature. As an alternative strategy, the Energy Trust of Oregon (ETO) launched a Nest thermostat pilot study. The Nest, a Wi-Fi enabled thermostat and control device, does not require installation of a low-voltage wire to connect the outdoor heat pump compressor to the indoor thermostat control panel. Additionally, the Nest thermostat retrieves outside air temperature data from the internet, schedules the compressor to run longer to achieve the target temperature rather than relying on backup heat and has a smart phone-based application to allow a homeowner to monitor and control their heat pump remotely. The Nest also includes a behavioral component, where customers can go online and set the control for "more comfort" or "more savings" and the heat pump backup cutover temperature changes. This set point may significantly impact the realized savings, especially since all thermostats installed as part of the pilot were set to the highest savings settings. The Nest has many other potentially valuable energy management features, including the ability to learn the occupant's schedule, a motion sensor that detects if occupants are away, and online control, including via a smartphone app. To assess the savings associated with Nest, Energy Trust recruited approximately 180 randomly selected homes to receive a free Nest thermostat and compare their energy consumption to a comparison group. Energy Trust also surveyed customers at the beginning and end of the pilot study to get feedback on the Nest thermostat and to gauge changes in behavior and attitudes towards the device. Survey participants were also asked about previous thermostat types and programming behavior to understand the likelihood of making manual adjustments to the Nest thermostat. Program and implementation staff were also interviewed to document challenges and learnings from the pilot. Ultimately, the evaluation will be used to determine whether the Nest thermostat and other smart thermostats with comparable features are a viable technology that can achieve cost effective electric savings from heat pumps on a large scale and should be offered through Energy Trust's Existing Homes program. The paper presents the findings from a recent process and impact evaluation for Energy Trust of Oregon that measured household winter heating electricity savings from the Nest thermostat, customer attitudes, behavior, and reception to the device, and lessons learned from implementing the pilot study.

4E:Using Bid Data for Evaluation

Moderator: Abigail Daken, EPA

Speaker: Ben Ho, Vassar College

Understanding Energy Efficiency Benefits from Smart Thermostats in Southern California

Programmable thermostats have repeatedly failed to live up to their energy efficiency potential, resulting in the end of many utility thermostat rebate programs and the suspension of the ENERGY STAR programmable thermostat certification program. On the other hand, our recent study of southern California households showed a 6.1% reduction in whole-home electricity use for customers that installed a smart thermostat connected to web and mobile software. The study results provide not only a framework for determining the sources of energy efficiency but also direction for helping more smart thermostat owners achieve positive energy efficiency results. EnergyHub set out to quantify the energy efficiency benefits of residential internet-connected "smart" thermostats distributed outside of utility programs. We also wanted to determine the sources of energy efficiency and what separates customers that achieved efficiency gains from those that did not. Finally, we were motivated to evaluate the impact of smart thermostat installations on residential peak load. From our study comparing whole home summer electricity usage before and after residential customers installed a smart thermostat, we learned that the primary determinant in the resulting change in electricity consumption was how much customers "fiddled" with their temperature settings and that the bulk of energy savings came from high use household. These results yield new insight into behavioral techniques that could encourage more efficient usage patterns. Using a model that controlled for outdoor weather changes, household characteristics, and seasonal effects, we also found a significant learning effect. Customers that installed smart thermostats initially saw an increase in their electricity usage as they used the new device to make regular manual adjustments to the settings. However, once they adapted the thermostat's programming to their particular usage needs, we saw lasting and substantial savings. Those who made the most use of the programming settings of the thermostats saw the largest reductions in their electricity consumption. From an implementation perspective, these results provide additional support for utilities and regulators employing or planning to employ rebates and subsidies for customer-selected smart thermostats deployed through a variety of channels. From a research perspective, this study provides a novel framework for determining the sources of energy efficiency from programmable thermostats and insights on where further efficiency opportunities exist. We look forward to sharing our model and experimental results with the BECC audience.

4F. Automate or Encourage? Behavioral Programs in Commercial Buildings

Moderator: Richard Huntley, richard.huntley@retroficiency.com

Speaker: James Russell, PECI

How energy analytics facilitate RCx program design and delivery

4F. Automate or Encourage? Behavioral Programs in Commercial Buildings

Moderator: Richard Huntley, richard.huntley@retroficiency.com

Speaker: Bill Younger, Clear Results

Achieving O&M and RCx savings in commercial and industrial sectors

4F. Automate or Encourage? Behavioral Programs in Commercial Buildings

Moderator: Richard Huntley, richard.huntley@retroficiency.com

Speaker: Amit Kulkarni, National Grid

Considerations for operational and behavioral approaches for commercial customers

5A: Lightning: Social Norms & Culture Change

Moderator: Rick Diamond, LBNL

Speaker: Ashley Ruiz, McKinstry

The Power of People: Behavior-Based Energy Conservation

There are three primary methods of producing significant energy savings in buildings: smart systems (capital upgrades/retrofits), smart operations (operational optimization), and smart people (cultural/behavioral change). But which of these should building owners focus on to produce the best possible savings? In this session, we will explore the behavioral approach to energy efficiency—engaging occupants and operators in changing behaviors to save energy and cut waste. This session will examine energy savings results and successes at various K-12 and local government facilities across the U.S. The organizations that will be discussed are participants in an energy-awareness and savings program called powerED, administered by McKinstry, an energy and facility services expert. McKinstry's powerED program uses a highly collaborative approach with three key elements of focus: people, process, and performance. The people component utilizes behavioral change best practices to engage building occupants in energy conservation; the process component identifies and implements low- and no-cost operational and maintenance strategies to reduce energy use; and the performance component tracks, measures, analyzes, and quantifies energy savings and carbon reductions to pinpoint opportunities, communicate performance, and promote success. During this session, we will dive deeper into energy results within multiple organizations, including a school district in Colorado. This school district presents a unique opportunity to compare various energy-saving strategies, as it contains schools that only installed capital retrofits, schools that only focused on behavioral change, and schools that did both. Through comprehensive utility bill data (electricity and natural gas) compared to a baseline year and weather regressed, we are able to understand the results and better explore the potentials of the people-centered approach to conservation. The results of McKinstry's behavioral approach indicate that habit change has the capacity to out-perform capital retrofits and upgrades when implemented comprehensively. Using best practices in community-based social marketing and the social science of behavioral change, some facilities achieved 20+% energy savings through changing behaviors alone. One school in particular reduced total energy use by 34% and domestic water use by 33% with no capital upgrades or retrofits. Through a combination of communication, peer influence, student engagement, strong leadership, comparative feedback, and building operator participation, these schools have successfully made habit changes that rival, if not exceed, energy savings of traditional capital retrofits. Join us for this session to explore successful cultural change approaches to conservation. Ultimately, energy efficiency isn't just about technology; it's about engaged people.

5A: Lightning: Social Norms & Culture Change

Moderator: Rick Diamond, LBNL

Speaker: Ulrika Wising, DNV GL

It's cultural: Energy Efficiency & Behavioral Programs for the industrial segment

In recent years there has been several studies showing that behavioral change can contribute to savings of 5-15% of the energy consumption of an industrial site. This was confirmed in a survey in 2011 of the Belgian and Dutch industry showing that behavioral change is both an opportunity and a challenge to achieve energy efficiency. The Energy Culture of an organization is the shared mindset that creates and sustains an environment leading to continual improvement of the energy performance of the organization. It is focused on the behaviors of the people of an organization and their impact on the energy use. In this paper, we will show how significant energy savings can be achieved by changing behavior. The first step is an assessment of the Energy Culture of an organization. This evaluation is based on eight different dimensions; Visibility, Accountability, Collaboration, Targeting, Commitment, Motivation, Learning and Progress, and is executed using a combination of data analysis, surveys, interviews and workshops. Once the assessment is completed, it is possible for an organization to develop an action plan to improve whatever dimension or combination of dimensions they want to focus on. Noted that often work on one dimension has positive effects on several dimensions simultaneously. A case study will be presented were this approach was implemented at a chemical manufacturer. The assessment was performed using surveys, interviews, workshops and observations. The result from the assessment was used to develop an action plan and this plan has now started to be implemented and gains already achieved. The majority of activity in this space has been the inclusion of behavioural programs in the energy efficiency portfolio of utilities directed at residential customers. Based on recent statistics on energy consumption in the United States, industrial energy consumption is over twice that of residential and commercial customers. This research and accompanying case study is hence extremely relevant and represents an important datapoint in a less studied area where the potential gains are significantly larger.

5A: Lightning: Social Norms & Culture Change

Moderator: Rick Diamond, LBNL

Speaker: Joana M. Abreu, Fraunhofer USA CSE

Understanding the Affect of User Effort on Electricity Feedback and Energy Savings

Visualizing energy consumption and providing user feedback has great potential for energy savings. However, a key outstanding problem in energy feedback is how to maintain energy savings and user engagement over the long-term. This is because users need to stay personally motivated to keep interacting with the information and the novelty of a new technology often diminishes quickly after an initial period of effectiveness. In the current study we empirically investigate this issue by either allowing users to get their own feedback or by providing alerts to users. Communication via personal alerts may be critical for true user engagement, as we know already that alerts are highly valued by energy users. Researchers have installed an energy monitoring system called the eGauge at the electrical mains in the seven buildings at Harvard Botanic Gardens. This system is compatible with a third party site called MyEragy. Tenants were given a choice to either create a login for the MyEragy portal or sign up for alerts provided by MyEragy. Results seem to indicate that although the email alerts acted as triggers for the email group to log into the MyEragy portal, this was not more effective than just giving participants access to the website. The non-email group was also was more conservative with electricity use, in comparison to the email group.

5A: Lightning: Social Norms & Culture Change

Moderator: Rick Diamond, LBNL

Speaker: Joan Glickman, U.S. Department of Energy

Home Energy Score Impact on Program Participation Rates

The U.S. Department of Energy (DOE) developed the Home Energy Score as a simple low-cost means to provide reliable information on the asset performance of a house. The score is easily understood by the public and is ultimately intended to be included on real estate multiple listing services, thereby enabling a home's energy efficiency level to be visible and accounted for at point of sale. It's too early to say how including a Score will affect home prices or homebuyers' decision-making, but research suggests that making certain types of information public can affect behavior. In one such study, the act of publicly recognizing individuals who voluntarily signed up for cutting peak demand resulted in higher participation levels. In light of these findings, DOE's Home Energy Score team reached out to two of its Partners in New Jersey and Connecticut to assess how adding a public recognition component to their program delivery affects the degree to which homeowners take actions to improve their home's efficiency. New Jersey Natural Gas (NJNG) added a recognition component to their Conserve to Preserve Community Rewards Program – a program focused on outreach through schools. In the observability/recognition group, all parents who voluntarily participate in NJNG's online or in-home energy audit will be publicly recognized as Energy Champions on posters and in other school communications materials. The hypothesis of this study is that public recognition will create a sense of positive peer pressure that will encourage parents to complete online and in-home audits. The study is structured as a quasi-experimental design. Six schools participated in the first phase of the study which started March 1, 2014 and will conclude May 31, 2014. The second phase of the study is planned for fall of 2014. In Connecticut, the state's Department of Energy and Environmental Protection, along with the state's primary utilities, are interested in evaluating the impact of public recognition on homeowner demand for Connecticut's in-home energy audits offered through its "Home Energy Solutions" program. Every home that goes through the Home Energy Solutions program will receive a Home Energy Score. In the first test group, homeowners will be offered the opportunity to make their Scores visible on a public map that is posted on the Energize Connecticut website. A second test group will also receive a Score but will be allowed to make a different metric (e.g., MMBtu) publicly visible on a map. The control group will go through the business as usual Home Energy Solutions program and will not be invited to participate in the online Home Energy Score map. The study is planned to start fall of 2014. The study will measure whether behavior of homeowners in the various groups differed and whether public disclosure of the Score or other energy information led to greater investment in improvements or greater numbers of audits in those neighborhoods. This session will offer preliminary results and findings from both studies, particularly with regard to participation in the in-home and online audits and level of investment in energy efficiency.

5A: Lightning: Social Norms & Culture Change

Moderator: Rick Diamond, LBNL

Speaker: Pat Aloise-Young, Colorado State University

Customers' Reasons for Opting out of Home Energy Reports

Consumers have been given information about their electricity usage for decades, ranging from low-tech forms such as door hangers (e.g., Battalio, Kagel, Winkler, & Winett, 1979) to modern in home displays (e.g., Alahmad, Wheeler, Schwer, Eiden, & Brumbaugh, 2012). Recently, that feedback has been expanded to include not only information about the individual's usage, but also social comparison information (i.e., normative feedback). Feedback has been shown to be effective in reducing electricity consumption (Ehrhardt-Martinez, Donnelly, & Laitner, 2010) and indeed, OPower has demonstrated that normative feedback can achieve savings of approximately 2% when distributed on a wide scale to utility customers (https://opower.com/results). Fort Collins, CO was one of the first communities to distribute OPower's Home Energy Reports (HER) to its customers. As with other OPower communities, the program was largely successful, but there were consumers who were unhappy with the program. Because OPower uses 'white branding' the Home Energy Reports appear to come from the utility rather than an external entity. Thus, consumers call the utility to ask questions about the program and to express approval/disapproval for the program. Importantly, because the reports are perceived to come from the utility, consumers' reactions to the reports can impact the relationship between the utility and its customer base. We analyzed 347 customer service logs from 2009-2010 for customers asking to opt out of the Fort Collins HER program. The entries were coded by two trained research assistants who placed the entries into 8 categories and achieved inter-rater reliabilities in excess of 90%. The most common reason for opting out was waste, with a third of customers claiming that the report was a waste of time, money, paper, etc. Concerns about accuracy and fairness were the next most common reasons for opting out: 18% inaccurate – saying that the reports aren't accurate or denying that they use more (i.e., they don't believe the results). 17% generic unfair – claiming that the comparison was unfair without providing an extenuating reason. 16% extenuating circumstances – claiming that their energy use was higher for reasons that were out of their control. Examples include: being home all day (e.g., retired, caring for a disabled individual, caring for children, or working from home) and having medical needs for electrical equipment. Relatively few consumers cited concerns about privacy or government intrusiveness: 12% privacy - saying that it isn't anyone's business how much energy they use. 6% 'big brother'- the utility is trying to control them, anti-government sentiment. Some consumers' reactions were quite emotional. A quarter of the entries were classed as emotional reactions, compared to only 3% classed as opting out because they did not care about the information. These results provide interesting information about people's reactions to social comparison information in general and consumers' reactions to home energy information in particular. White branding of the home energy reports has important implications for messaging by utility companies in order to protect their relationship with their customers.

5A: Lightning: Social Norms & Culture Change

Moderator: Rick Diamond, LBNL

Speaker: Lise Tjorring, South Energy/University of Copenhagen

We Forgot Half of the Population! The Significance of Gender in Energy Renovation

High energy consumption is an on-going problem for the Danish government's climate plan of getting 50% of the electrical power consumption to come from wind mills by 2020 and making the country's energy supply fossil free by 2050. The responsibility for accomplishing the plan has partly been handed out to local energy companies, that are now obliged by law to lower their customers' energy consumption. An increasing focus point for the government as well as the local energy companies are the private households that account for 25% of the total energy consumption. The greatest potential for lowering the energy consumption in the private households is getting people to make an energy renovation of their house. So far the effort has been concentrated around economic incentives and technical home solutions in order to make it as easy, comfortable and economical as possible to choose an energy renovation. Although the present effort is successful in many aspects, it has also served as a constant reminder of how little is known about what happens inside these private homes and how people in their everyday lives practice and make decisions about their home. This paper explores everyday life inside these homes. The specific focus is on dissolving the idea of private families constituting homogenous units. Instead families are viewed as individuals in complex relationships, who discuss, argue and negotiate future decisions about their home. The paper is based on an anthropological fieldwork study of ten families in the municipality of Sonderborg, Denmark. They are followed on their journey of decision-making in the process of receiving free energy advice from the local energy company to experiencing what in many cases end as an energy renovation project in the home. The research indicates that gender plays a significant role in the decision making process. Energy is seen as the man's province both by men, women and tradesmen, and it is most often expected that it is the man who reads the meter and controls the decision making process about energy matters. However, on an everyday basis both man and woman are users and co-creators of their home. Albeit having different practices and preferences within the house, they constantly meet, influence each other and negotiate their ideas and preferences. The reason why energy has obtained its rather curious status as the man's province is most likely because it has become entangled in a net of technicality. Energy is associated with cavity wall insulations, polycrystalline solar cells, vapour barriers etc., and women are made/make themselves passive, when confronted with these technicalities. Taking gender into consideration rather than merely focusing on economic incentives and technical home solutions can help create social innovative answers to promoting energy renovations in private households. It calls for educating energy advisers not just as technical experts, and focusing on communicating with the women. There is an unexplored potential for targeting the forgotten 50% of the population.

5A: Lightning: Social Norms & Culture Change

Moderator: Rick Diamond, LBNL

Speaker: Bruce Tonn, Oak Ridge National Laboratory

Changes in Energy Behaviors Post-Weatherization by Low-Income Households

A random and nationally representative sample of over 1400 low-income households was surveyed about their energy use behaviors pre- and post-weatherization. All homes were in line to receive or had already received weatherization through the U.S. Department of Energy's Weatherization Assistance Program. The treatment group was surveyed just prior to having their energy audits and again approximately eighteen to twenty-four months later. A comparison group of households living in homes weatherized one year previously were surveyed at both times. The survey was first administered in 2011 and then again in 2013. The survey design allows for comparison of changes in energy use behavior between the pre-weatherization treatment group and the same households post-weatherization, the pre-weatherization group and the comparison group in the 2011 time frame, and the comparison group one-year post-weatherization and approximately three-years post-weatherization. The paper will present comparisons in these areas: changes in the use of heating and cooling equipment; changes in home ventilation (e.g., opening of windows); changes in the use of thermostats (e.g., setback at night); and changes in the use of appliances. Any changes in respondents' knowledge about how thermostats work will also be presented. Lastly, households will be clustered according to their rate of adoption of energy savings behaviors post-weatherization. Descriptive statistics for a comprehensive set of demographic variables will be calculated for each cluster group to gain insights into what types of households are more likely to change their energy behaviors post-weatherization.

5A: Lightning: Social Norms & Culture Change

Moderator: Rick Diamond, LBNL

Speaker: Timothy Treadwell, California Center for Sustainable Energy

Politics, Values, and PV System Design

There is a well-established link between political ideology and responsiveness to messaging/framing on environmentally beneficial technologies, such as hybrid vehicles and energy efficiency (Costa & Kahn, 2013; Gromet et al., 2013; Hardisty et al., 2010; Kahn, 2007). This body of work provides valuable insight into the importance of considering ideological values and beliefs when trying to influence consumer behavior and drive technology adoption. Our research builds on this literature by exploring how political ideology influences the perceived value of solar PV among a sample of adopters in the San Diego region. Furthermore, we examine the potential consequences of these perceptions (and the underlying values they stem from) on individuals' system sizing decision and the ultimate financial performance of their PV investment. To examine these questions, we use a combination of survey and energy consumption data collected from a sample of solar PV adopters in the San Diego region. First, survey data was used in a series of econometric models to quantify the impact of political ideology, as well as a various other factors, on the perceived value of solar. These models revealed a consistent, measurable impact of political leaning on perceived value. The more politically conservative individuals were, the greater the value they placed on the monetary benefits of PV adoption: lowering electricity costs and protection from future rate increases. The environmental benefits of PV, however, resonated more with those on the political left, as the more politically liberal participants were, the more they valued the environmental benefit of PV adoption. Therefore, how individuals identify politically is related to which features of PV they most value. We next examined whether political ideology (and its associated value) predicted the size of the system that PV adopters purchase. One possibility is that politically conservative customers, who are more motivated by financial benefits of PV, might size their system in an economically optimal way (i.e., reducing their residual bills to the optimal cost-saving point). In contrast, politically liberal customers, who are more motivated by the environmental benefits of PV, would purchase economically oversized systems to reduce their carbon emissions to the smallest amount possible (and thus reducing residual bills below the optimal point). To examine system sizing, each customer's monthly energy usage prior to installing solar was used in conjunction with system configuration data from the rebate application to calculate residual bills. This calculated residual bill was then used as the dependent variable in a second series of econometric models to predict system size. Surprisingly, the political variables were not significant predictors of system sizing and economic outcomes. The best predictors of system sizing were income and age, both associated with larger systems and smaller residual bills. Therefore, it appears that while customers are drawn to adopt solar for various political/value-based reasons, the transaction process that occurs during the system purchase leads to customer convergence on system sizing regardless of their initial motivations for adopting.

5B: Advances in Media & Marketing

Moderator: Maria Vargas, US DOE

Speaker: Emmanuel Hales, 2rw Consultants Inc

Marketing Behavior-Based Energy Efficiency: How to Get a "Yes" in a Room Full of "No's"?

Marketing Behavior-Based Energy Efficiency: How to Get a "Yes" in a Room Full of "No's"? For 2rw Consultants, Inc., an energy and engineering firm, it became apparent early on that no matter how energy efficient a building is designed to be, it can only be as efficient as the people who use it. Capital investments are only part of the energy efficiency equation; in order for a building to reach its full energy efficiency potential a culture of energy efficiency must also be in place. It was with this motivation that 2rw developed EnergyVibe, an outreach program designed to engage building occupants in turning energy efficient behaviors into habits. Energy awareness campaigns can have a positive impact on people, profits, and planet: they can reduce utility costs, promote teamwork, and contribute to a corporate sustainability image. Compared to capital improvements, behavior-based energy efficiency is appealing because it requires relatively little investment. Despite these benefits, getting commitment from organizations to sign on to EnergyVibe was much more difficult than expected. Many organizations were resistant to take action without an immediate crisis at hand. Some were short-staffed and were afraid an energy awareness program would disrupt work flow, and others felt they could develop programs themselves with free information from the internet. The foremost obstacle to sale was the perceived risk associated with the difficulty of guaranteeing energy savings resulting from human behavior. Even organizations that were deeply committed to sustainability were reluctant to sign on the dotted line without a concrete figure for how much EnergyVibe would impact their bottom line. In this presentation, the program managers of EnergyVibe will share their experiences about how they were able to turn these “No’s” into “Yes’s”. Building from the reasons why organizations are hesitant to prioritize behavior as an energy efficiency strategy, participants will learn techniques for guiding organizations to understand the full value of behavior-based energy efficiency in the context of their core mission and sustainability goals.

5B: Advances in Media & Marketing

Moderator: Maria Vargas, US DOE

Speaker: Roya Kazemi, NYC Mayor's Office

Implementing Successful Behavior Change Programs with Limited Resources: Lessons from City of New York

GreeNYC, NYC's behavior change program, has generated 2 billion media impressions, created recognition with 40% of NYC's residents, done pioneering research and achieved measurable environmental benefits in a relatively short amount of time with very limited resources. The Director of GreeNYC will share information on GreeNYC's successful brand strategy as well as the role of public-private partnerships and intra-governmental partnerships in executing successful marketing campaigns. This presentation will provide inspiration to practitioners working in any sector (government, not-for-profits, utilities, and private sector).

5B: Advances in Media & Marketing

Moderator: Maria Vargas, US DOE

Speaker: Sue Kochan, Brand Cool

Driving Energy Efficiency in New York State by Going Beyond "Barrier" with Humor and Humanity

When was the last time something about energy efficiency made you laugh? Mixing government energy-efficiency and conservation initiatives with humorous marketing campaigns isn't something that's seen very often. Yet, with cable TV and the Internet further fragmenting and saturating the media market, the challenge of creating content capable of reaching, cutting through, and engaging people now requires approaches that recognize humans are fully "human," not simply "rational actors." For years, cause-based marketing has relied on elements proven to capture attention: shocking stats, serious stories and images that tug at one's heart strings. These tactics still garner results; however, in recent years there's been a growing trend toward marketing that both inspires and makes people feel good. Our work in NYS demonstrates it's not exclusively humor that does this, but it's absolutely effective. Humor immediately makes us receptive because it drops our built-in defenses. Making the messages and stories we broadcast relatable allows people to see themselves in our campaigns, which is particularly important because "buying" energy efficiency isn't exactly top of mind. Our efforts to increase participation must extend beyond the known external barriers by addressing the less visible, less conscious internal "barriers" such as emotions, beliefs and identities that impact both our behaviors and purchasing decisions. When we're able to connect on a human level with our audiences, we're able to take advantage of the onslaught of digital and social media that is fueling cause-based and advocacy marketing. We have instant access to supporters, as well as the opportunity to turn them into ambassadors who are willing to share a brand's messages with the hundreds or thousands of friends in their networks. The only trick to tapping this opportunity is that the content needs to acknowledge the psychological realities of being human to be highly engaging and highly shareable. According to a 2012 study on the Psychology of Sharing conducted by the New York Times' Customer Insight Group, the top five factors influencing online sharing include 1) ability to appeal to the customer's motivation to connect with others, 2) establish trust, 3) keep the content simple, 4) use a sense of humor, and 5) embrace urgency. Using digital content trends, social sciences, and market segmentation research conducted on New York State homeowners and shoppers, the New York State Research and Development Authority has created Point-of-Purchase displays, sales associate training, and online memorable content "sticky" enough to humanize energy and create market traction for the state's Home Performance with ENERGY STAR® program and ENERGY STAR® products and lighting retail sales. The Telly-award winning Home Performance with ENERGY STAR® webisode series, called Irreconcilable Temperatures, tells the story of a young couple fighting over the thermostat, worrying about money and ultimately making energy-saving upgrades to their home through the program. The humorous videos make a complicated program entertaining to learn about, while offering a downloadable home assessment application and the ability to find local contractors. Supported by a fully integrated advertising and PR campaign the webisode series attracted nearly 140,000 visitors who spent an average of 4.27 minutes on the site compared to the industry average of less than a minute. To date, the campaign has generated more than 23,000 qualified leads for the program and directly led to more than 2,200 conversions. Using this case, and the recently launched ENERGY STAR products and appliances campaign, we will discuss tips for combining psychological, behavioral and economic principles with segmentation research to create characters and storylines that humanize energy to increase campaign success.

5B: Advances in Media & Marketing

Moderator: Maria Vargas, US DOE

Speaker: Debbie Slobe, Resource Media

Beyond the CFL: Winning Energy Efficiency Imagery

PRESENTATION DESCRIPTION What is the first image that comes to mind when you think of the words, "energy efficiency"? We asked this question to a standing room only crowd during the Storytelling session at last year's BECC conference. Most people shot up their hands when we showed them a picture of a CFL light bulb. Their response was a stark reminder of how hard it is for people to visualize something that is essentially invisible, and how few images exist that effectively illustrate the multiple benefits of energy efficiency in compelling ways that help move people to act. This is about to change. Resource Media recently completed a research project that sheds new light onto effective imagery for energy efficiency, which we expect will shatter the tired, old CFL image of this incredible resource. In this proposed BECC presentation, lead researcher Debbie Slobe will answer questions such as: 1. Which images are most effective to convey the intangible benefits of energy efficiency, such as increased comfort, health and security? 2. What visual narratives are most effective in motivating audiences to take action to save energy? 3. What images and image/word combinations are most likely to be shared on social media? 4. How can organizations do a better job humanizing their energy efficiency outreach efforts and move away from impersonal, technology-driven materials and visuals? 5. What are some inexpensive and effective ways organizations can test images prior to launching campaigns? This research builds upon our successful "Seeing is Believing" visual storytelling guide (http://www.resource-media.org/visual-story-lab/report/), which is based on our two-year investigation into the art of science of using pictures to influence, move and motivate people, and was the focus of our BECC presentation last year. This guide is now being used by organizations around the globe to improve their use of imagery and visual storytelling techniques, from managers of UNESCO's Marine World Heritage Sites to the Alaska Wilderness League as it fights off drilling in the Arctic National Wildlife Refuge. It also builds on our recent coal and clean energy image testing project (http://www.resource-media.org/3-pictures-pop-findings-photo-testing-study/#.U1F3fscmr95), completed the end of 2013, which groups working on energy issues across around the country are drawing on – from Southern Alliance for Clean Energy in the southeast to New Energy Economy in the southwest to RE-Sources in the pacific northwest to Fresh Energy in the upper midwest. As Resource Media's lead on all things energy efficiency, Debbie Slobe has extensive experience developing and deploying effective communications campaigns to advance various energy efficiency policies and standards, such as energy efficiency resource standards, building energy codes, appliance standards, and building energy benchmarking policy. She has worked extensively with the American Council for an Energy-Efficient Economy, Southwest Energy Efficiency Project, Institute for Market Transformation, California Energy Commission, Global Buildings Performance Network, New Buildings Institute and others.

5C: Reaching Low Income and Underserved Communities 2

Moderator: Michael Nye, US EPA

Speaker: Justin Woodjack, UC Davis

Designing a Public Energy Feedback Interface

This paper discusses the process behind the creation of a public energy feedback interface designed to engage individuals and their communities through visual encounters of the tangible feedback and responsive behaviors, with the ultimate goal of impacting a community's perceptions of energy and reducing its energy consumption. The paper will also discuss early results from a residential energy feedback intervention on campus of UC Davis West Village Zero-Net-Energy community. The field trial includes two for a period of 9 months (3 baseline months, and 6 months for feedback experimentation). The study involves surveys and interviews before and after the intervention to understand change in human perceptions, knowledge and attitudes towards energy, as well as high resolution energy data on the units to observe any effect on energy consumption. Development on the current prototype, codenamed SESEME (Social Energy Sensing Monument), began in June 2013. The physical object's primary function is to express building energy data through motion and light in the public context. Some of its features include: infrared and bluetooth based proximity sensors which allow reactivity to physical presences, variable-color LED lights that facilitate assessment-based, qualitative communication, and a miniaturized web server that allow near-instantaneous reflection of changing data. Our intention is to enclose these and other technologies inside the interior of a statuesque public monument, resulting in a surprising, dynamic object that captures the possibilities of contemporary computing without appearing overtly to be an (easily-ignored) electronic informational display. Ubiquitous computing advances the educational capabilities of SESEME and allows it to become a social experience as well: onboard Bluetooth will prompt those nearby with smartphones to access a digital energy interface that allows interactive perusal of more contextual information. As users browse through energy data, the physical object will move in kind to reflect it, essentially turning energy explorations into kinetic manipulation and potential public spectacle. The overall objective of the object's design is to foster senses of surprise, leading to engagement and potential behavior change, through community goal-oriented feedback. The creative process involved in designing and constructing a cohesive digital and physical energy feedback system relied on intense cross-disciplinary collaboration between designers, computer programmers, engineers, and behavioral scientists and extensive research into network technology, mechanical actuation, material properties, human-centered interface design, and emotive robotics. We believe that combining principles typically espoused in architecture and animation with efficient engineering and bleeding-edge computing in the service of reducing energy use will result in revolutionary experimental solutions that can contribute much to the energy behavior and climate change canon.

5C: Reaching Low Income and Underserved Communities 2

Moderator: Michael Nye, US EPA

Speaker: Mickey Lee, MPower Oregon, LLC

Behavioral Economics in Practice – MPower Oregon is empowering residents to reap savings through simple, supported changes.

Behavioral Economics in Practice – MPower Oregon is empowering residents to reap savings through simple, supported changes. Are program implementers using Behavioral Economics to its highest potential to help consumers save more energy? Some utilities -provide Home Energy Reports to help customers save energy; however, there are many other design strategies and insights through Behavioral Economics which are impactful and currently under-utilized in the energy efficiency industry. MPower Oregon (MPower) provides coordination services, financing, and post implementation support for efficiency improvements, helping affordable multifamily property owners and residents save energy and water. This abstract will focus on one aspect of MPower's services; Resident Engagement. MPower's Resident Engagement service demonstrates unique insights from Behavioral Economics to motivate tenants to reduce their energy consumption. The engagement methodology is to install various low-cost reminder devices within the tenant spaces to influence behaviors through choice architecture and overcoming common barriers of limited attention and habitualized actions. For specific building types, the results are measured through monitoring the energy and water usage, and surveying tenants to evaluate metrics such as adoption rate, actions, and attitudes. Resident Engagement services are based on a simple tiered plan for implementing high-impact strategies to successfully achieve savings through targeted behaviors; summarized by following seven steps: 1. Understand your community 2. Develop key areas of focus 3. Develop engagement strategies 4. Establish program infrastructure 5. Execute program 6. Track progress & Evaluate success 7. Create a culture of sustainability Behavioral tactics becomes crucial to MPower's financial model by relying on behavioral savings to act as a buffer or credit enhancement to secure the overall projected savings for the technology improvements. MPower realizes tenants have as much of an effect on energy consumption in the buildings as facility and maintenance staff. Another reason is that MPower is able to empower tenants; especially those who pay their own energy bills, to take control of their energy consumption and realize the associated dollar savings. Mpower's goal is to provide a holistic solution that tries to maximize the benefits of energy conservation to help preserve the affordable housing market. We demonstrate the benefits of using an innovative and 'easy-to-implement' approach that fosters a culture of conservation in the affordable multifamily sector. About MPower Oregon: In July 2011, a coalition of local, regional, and national organizations came together to sign a Declaration of Cooperation for the development of an innovative public-private partnership aimed at delivering low-cost energy and water efficiency financing to the affordable multifamily rental-housing sector. The partner organizations recognized the potential of the MPower model as an innovative triple bottom line solution to economic, environmental, and social challenges. The following are the partner organizations that currently contribute to this MPower Oregon Program: • Network for Oregon Affordable Housing • Energy Trust of Oregon • Enterprise Community Partners • Green For All • Walsh Construction • U.S. Department of Housing and Urban Development • Oregon Department of Energy • MacArthur Foundation • Craft3

5C: Reaching Low Income and Underserved Communities 2

Moderator: Michael Nye, US EPA

Speaker: Dana D'Souza, SERA

What Do the Military and Low Income Populations Have in Common? A lot more than you think!

The presenters will share their experiences in measuring the impacts, successes, and shortcomings of behavioral approaches in two distinct yet similar populations. The presentation, as proposed, will document two recent behavior change programs the authors were associated with including their goals, implementation process, and outcomes. We will cover the differences in the target audiences and discuss impact the audience's motivations, barriers, and baseline condition had on each of the program's designs. Although the two programs were separated by thousands of miles and seemingly large cultural gaps, when it came to what messaging 'works' and how to motivate change, the audiences had more in common than not. The two case studies to be discussed include: • Project 1: A groundbreaking social marketing campaign completed with a branch of the armed forces. The program sought to reduce energy, water, and resource use throughout all of the facilities in a state by changing the behaviors of over 4,000 occupants (both full and part time). The case study will cover the campaign's beta test, the measured impacts of the test, and the changes completed to make the program a success prior to full deployment. • Project 2: This project focused on changing food disposal related behaviors in two low-income neighborhoods in a north east city. The City sought to encourage participants to send food scraps down newly installed disposers to the City's waste water treatment facility where the methane gas could be captured for energy production. The case study will include the impacts of the program on the households and the city (measured through focus groups, surveying, and quantitative data analysis) as well as the next steps in the program's evolution. For both programs the authors will discuss the importance of measurement and tracking, and provide estimates of the program's associated impacts. In order for behavior modification programs to be taken seriously (in terms of both funding and effort) it is necessary to document their impacts. The presentation will outline the steps used to accurately assess the impacts of actions and behaviors (baseline measurement, control groups, tracking, etc.) of each of the programs. The presentation will end with an overview of the lessons learned and their significance to programs in other parts of the country.

5D: Using Technology to Enable Utility Programs

Moderator: Kat Donelly, Empower Devices

Speaker: Scott Hublou, EcoFactor

Energy Efficiency: Opportunities in Remote HVAC Performance Monitoring

Everyone is familiar with the check engine light in an automobile. When it turns on, it means that that it's time to get your engine checked. When you apply this early warning concept to the HVAC, which accounts for more than half of all residential energy consumption, it could mean big opportunities for energy efficiency and savings and the HVAC market. Consumers could potentially save thousands on repairs and energy costs by identifying HVAC system malfunctions early. In addition, new energy efficiency standards will affect the HVAC industry including the mandatory inclusion of Fault Detection and Diagnostics (FDD) in commercial roof top HVAC systems in building codes such as California's Title 24. One approach, remote HVAC monitoring, is becoming an emerging and powerful alternative to expensive hardware solutions. The presentation will discuss the opportunities and benefits for residential HVAC monitoring services from greater energy efficiency to the ability for HVAC dealers to enhance the value of their service contracts and to lower customer acquisition costs. We will also provide insights into EcoFactor's HVAC trial evaluating thousands of homes to show how remote HVAC diagnostics works in the real world. The results of the trial support the widely-held belief in the HVAC industry that millions of American homes have problems with their heating and cooling systems that go undetected – problems that represent big opportunities to save both energy and money. More significant was the finding that many of these issues can be accurately recognized through data derived solely from an "off-the-shelf" communicating thermostat.

5D: Using Technology to Enable Utility Programs

Moderator: Kat Donelly, Empower Devices

Speaker: Jim Parks, SMUD

Residential Demand Response Precooling Pilot and Results

The objective of this study was to determine how different precooling strategies prior to direct load control events affect hourly load impacts and participant comfort. Two precooling strategies were tested in addition to a business-as-usual scenario of "no precool". One precooling strategy was a "long-shallow" precool of 6 hours at 2°F, and the other was a "short-deep" precool of 2 hours at an offset of 4°F below the minimum peak setpoint. This design allowed comparisons of precooling strategies of differing length and magnitude to each other, to the business-as-usual case, and also to a baseline case of no precooling, no event. The study included: • Field study preparation included development of website and customer recruitment/information materials • Invitation mailings and follow-up • Installation of thermostats and customer training • Pre-treatment customer surveys • Post-event surveys after 8 called events during the summer • Participant satisfaction surveys • Final evaluation Customers were randomly selected to receive recruitment materials and were signed up on a "first-come, first-served" basis. A contractor installed the thermostat and worked with the customer to program the thermostat on-site and provide a brief tutorial of the thermostat features. Customers were allowed to opt-out of called events and were allowed to choose between SMUD or customer control of the thermostat. Participants were surveyed multiple times throughout this pilot to determine comfort levels, reasons for participating in the pilot, satisfaction with the program and satisfaction with the technology. The pilot • Trained customers on demand response purpose and technologies • Helped identify demand response comfort levels that are acceptable to customers • Provided customers with choice of control strategies • Yielded positive demand response results • Showed that customers are willing to adjust their behavior to save money and/or support a program they believe in • Showed that a small percentage of customer comprise the bulk of the opt-outs.

5D: Using Technology to Enable Utility Programs

Moderator: Kat Donelly, Empower Devices

Speaker: Kimberly Conley, PG&E

Beyond Direct Load Control: HAN and Customer-Centric Behavioral DR

Speaker: Kimberly Conley Home and Business Area Networks (HAN) provide real-time information directly from a SmartMeterTM about energy consumption in near real-time, enabling people to make informed changes to reduce their energy usage and costs. PG&E began implementing the Initial Rollout phase in March 2012 by installing 400 In Home Displays (IHDs) in customers' homes to determine how they engage with the device and to get feedback on processes and ways to improve the customer experience. Results from that study were impressive: 5.6% monthly load reduction; high engagement with the device even six months after first receiving it; 60+% of participants changed the way they used electricity based on information from the IHD, including more energy saving actions (e.g. turning of lights, installing power strips, reprogramming thermostats, and identifying and replacing "energy hog" appliances). PG&E was directly involved in checking customer eligibility, loading devices to the system, pairing devices to the customers' meters, and then enabling devices. (PG&E tested and validated five devices that are available through retail channels, but devices are not restricted to those five.) PG&E then implemented plans to make HAN scalable and available to customers in a streamlined way. In mid-January of 2013, the second phase of the HAN platform began, which was referred to as the Self Service model. By early 2014, the HAN device eligibility and registration process was fully automated through the MyEnergy (on www.pge.com), allowing the platform to scale and support requests at volume. Now customers can log into their account, access their HAN Dashboard, and the system automatically checks eligibility. Eligible residential and Small Medium Business (SMB) customers can register and pair their device to the SmartMeterTM in ~10 minutes using the self-service portal without PG&E intervention. PG&E is now in the HAN Demand Response (DR) Integration phase. Residential and SMB customers with HAN devices will receive near real-time pricing through the SmartMeterTM, presenting energy pricing over time (time-based rates) or pricing tiers (standard tiered rates). Capabilities will also include bill forecast and bill-to-date based on current usage patterns, as well as notification of DR events. During a pilot in the summer of 2014, PG&E will provide test customers with devices; PG&E plans for mass market rollout in 2015, when customers will purchase their own devices. PG&E's HAN platform offers residential and SMB customers the opportunity to participate in DR events in a customer-centric way, allowing them to choose their own behaviors based on usage and pricing information provided by PG&E, giving them control over balancing their comfort and costs. Moving forward, PG&E will evaluate Direct Load Control (DLC) over HAN to complete a suite of customer offerings ranging from information only to utility controlled programs such as AC cycling or Direct Load Control. PG&E is, to our knowledge, the only utility implementing a scalable HAN platform with a behavioral DR customer offering. At BECC, PG&E will present initial results from the summer 2014 HAN DR integration pilot and discuss relevant impacts on customers, utility programs, vendors and regulators.

5D: Using Technology to Enable Utility Programs

Moderator: Kat Donelly, Empower Devices

Speaker: Carol Yin, Yinsight, Inc.

Assessing Customer Solutions at the Intersection of Behavior and Technology

The California Statewide Emerging Technologies Program (ETP) is uniquely positioned within the California investor-owned utilities to assess potential measures and solutions for customer demand response programs. In recent years, its mission has expanded to include solutions that use technologies to change behavior and research on understanding customer preferences and behavior around new technologies. To address and prioritize these needs, Southern California Edison' ETP presents their approach for navigating proposals that use behavior to mediate technology use, as well as ideas that use technology to mediate behavior. This approach is new, and is set within the larger context of "ideation" of new program approaches that move beyond widgets, to systems-level "solutions". ETP actively solicits new ideas through several channels, and works with technology and solution developers across multiple stages of the product development lifecycle. With early stage, pre-commercial technologies, ETP provides regular outreach to inform and educate third parties about utility and regulatory requirements for suitable measures. With emerging technologies and solutions, ETP conducts assessments and demonstrations to verify energy savings potential. With newly commercialized or underutilized technologies, ETP supports utility efforts to introduce new solutions on a limited scale. With the recent interest in behavioral-based solutions, ETP adapts these efforts to accommodate California's unique requirements for claiming energy savings from behavior. We present the utility and regulatory requirements for claiming energy savings from behavior change programs, and offer advice to those who are interested in proposing behavior-based solutions to utility program designers.

5E: Organizational Behavior

Moderator: Elizabeth Malone, PNNL

Speaker: Michelle Cross, AEP Ohio

Industrial Continuous Energy Improvement

AEP Ohio launched the Continuous Energy Improvement Program (CEI) fourth quarter of 2012, for its large industrial customers. The program offers a strategic energy management approach to achieving low cost/no cost energy savings. The CEI program brings industrial customers together in a group (called a cohort) to participate in a series of twelve workshops throughout the year and establishes an Energy Team with an Energy Champion and an Energy Sponsor within the organization. The workshops are designed to educate the Energy Team, understand their energy use and identify opportunities for savings. The 12 month CEI program duration allows participants to ramp up efforts, overcome barriers and encourages them to develop long term practices leading to lasting cultural change. Important CEI program elements include: 1.) Creating a foundation for change through executive support and formation of an energy team led by an energy champion. 2.) Developing and maintaining an energy tracking model, based on energy intensity, which quantifies savings and provides feedback on energy usage. 3.) Engaging the entire organization to provide ideas and support changes aimed at energy reduction. 4.) Utilizing resources to plan and maintain a structured, consistent approach to energy management. Since 2013, AEP Ohio has launched four cohorts throughout the State, which consists of 36 participating customers. Many companies demonstrated interest in the program which quickly completed the recruiting process within three months of program launch. The first CEI Cohort (workshops completed January 2014) consisted of 14 diverse large industrial firms. The 2013 plan goal for the CEI program was 15 Million kWh's. In 2013, Cohort 1 greatly exceeded the annual goal by 142% and collectively saving 21.3 Million kWh's (attributable solely to low/no cost measures). This represented 4.4% of the participants' combined annual electrical energy usage. Individual performance within the cohort varied and peaked as high as 13.3% of the organization's annual usage. In addition to the low/no cost savings, the CEI program identified energy efficiency opportunities that require capital investments. CEI Participants applied for an additional 11 Million kWh's in capital project savings through the traditional programs. Companies in cohorts two, three and four are currently active in the program's first year (as of March 2014), however final savings estimates will not be available until 4th quarter 2014. Each participant has faced unique challenges throughout the first program year and has developed unique energy saving opportunities. Customer survey results and testimonials, specific to the CEI program, reflect the enormous amount of positive feedback we've received regarding the program value. Not only has the CEI program exceeded the kWh savings goal but has proven to be a valuable resource in improving the overall customer experience and has attributed to AEP Ohio's position as a trusted energy advisor. The program has not only exceeded in providing substantial kWh energy savings but has also has built better customer relationships through monthly meetings and establishing a program that is valued by customers.

5E: Organizational Behavior

Moderator: Elizabeth Malone, PNNL

Speaker: Maria T. Vargas, Department of Energy

Real World Examples of Driving Organizational Behavior Change: Better Buildings Challenge Partners Share Their Successes

Better Buildings Challenge Partners commit to 20% energy savings across their building portfolios over ten years. In achieving their goals, Partners share their results and details on the energy upgrade projects they choose to implement at their organizations and in other instances the steps a city, county, or state has taken to change policy or partner with the private sector. These implementation models are developed by Partners and often include specific solutions to change behavior within an organization or across the commercial, industrial, public, and residential sectors. and Examples of implementation models with a focus on behavior change include: El Paso launched a six-month Library Energy Challenge engaging City employees and library users in behavioral conservation measures and developed an implementation model, Employee Behavior Change, advances energy efficiency by encouraging employee behavioral changes involving energy awareness and conservation. State of North Carolina's Implementation Model, Utility Savings Initiative involved working with Agencies and universities to designate liaisons in their organizations to manage energy and water as resources. Collaboration increased within and across agencies and universities as they encouraged personnel to contribute to the energy reduction goal by being mindful of individual impacts. HEI's Implementation Model on the Energy Looking Glass Dashboard facilitates organizational behavior change by encouraging teamwork to meet company goals. HEI developed the Energy Looking Glass Dashboard, an energy management tracking tool that analyzes key variables such as weather normalized utility consumption, and hotel occupancy alongside capital and operational energy efficiency initiatives. It serves not only to track energy use and compare use across facilities, but it facilitates organizational behavior change by encouraging teamwork to meet company goals. Legrand, a manufacturer of products and systems for electrical installations developed the implementation model, Submetering Initiative and Energy Dashboards about the installation of submetering devices to capture data that drives employee behavior change. Also, to drive employee behavior change, Legrand held a "shut it off" contest across their facilities, encouraging employees to reduce energy use.

5E: Organizational Behavior

Moderator: Elizabeth Malone, PNNL

Speaker: William Prindle, ICF International

Organize Your Data! How Federal Energy Data Infrastructure Supports Organizational Behavior Change

Much of the focus to date on energy-use behavior has been on residential customers. Yet most U.S. energy consumption flows not through households but through organizations. In addition, significant uncertainties continue to exist on the persistence and predictability of desired changes in household energy usage behavior; yet leading organizations have documented significant energy savings robustly over multiyear periods. This suggests a need for a greater focus on organizational behavior as an under-used source of energy savings. Initial experience, however, also suggests a need for data infrastructure to support organizations in such efforts: these include data access and exchange policies and standards, data analysis and normalization tools, and data management systems. At the federal level, DOE and EPA have been working to help build this emerging data infrastructure: from EPA's Portfolio Manager operational ratings to DOE's new Asset Rating tool, to data exchange standards such as Green Button and the Building Energy Data Exchange Specification. This session will include Cody Taylor from U.S. DOE, who leads a number of DOE's energy data initiatives, and Bill Prindle ICF International, who has published on organizational behavior and energy management and supports DOE and other federal data efforts. (Note: we are prepared to make this a full session, including speakers from a utility and a local government who are implementing DOE data innovations.) Attendees will gain a fuller understanding of the big picture of the nation's emerging energy data infrastructure, and of the practical applications that support behavior change at the building level and the organization level.

5F: Is time on our side? The temporal dimensions of energy conservation

Moderator: Michelle Vigen, Montgomery County

Speaker: Omar Asensio, UCLA

Framing Effects and the Dynamics of Energy Conservation Behavior

Little is known about the effect of message framing on conservation behavior over time. In a randomized controlled trial with residential consumers, we test how the information context about daily household energy use impacts the dynamics of conservation behavior down to the appliance level. Our results show that while consumers immediately react to the novelty of tailored informational messages about their household electricity use, the effects of repeated information provision decay over time. Using a health-based frame, in which consumers consider the human health effects of their marginal electricity use, we demonstrate strong persistence of induced energy savings behavior; whereas using a more traditional cost savings frame, we observe a sharp attenuation of treatment effects over time. Our results suggest that health-based considerations have greater longevity versus small monetary rewards in meeting energy conservation goals. We discuss implications of our findings for the design of effective information campaigns to engage consumers on household consumption decisions.

5F: Is time on our side? The temporal dimensions of energy conservation

Moderator: Michelle Vigen, Montgomery County

Speaker: Derya Eryilmaz, University of Minnesota

Environmental Implications of Price Responsiveness in the Midwest Electricity Market

Dynamic pricing, usually known as real-time pricing, allows electricity users to observe real-time electricity prices and to allow consumers to adjust their electricity consumption behavior based on hourly price changes in the wholesale market. Real-time pricing offers one potential tool to reduce electricity costs, save on large investments in transmission lines, reduce the probability of spikes in the wholesale electricity markets, promote fairness in the market, and ultimately contribute to market efficiency of electricity consumption (Mansur and Holland, 2008; Caves et al., 2000). Real-time pricing may also have important environmental effects due to considerable variation in electricity demand during the day (Mansur and Holland, 2008). Changes in electricity demand may impact electricity generation and its concomitant production of emissions. For example, during peak demand hours, generators increase their load to meet higher demand, which in turn increases real-time electricity prices. Increase in the generation load then also leads to an increase in consumption of sources of emission, in particular coal, natural gas, diesel oil, and petroleum. However, the environmental implications that may follow real-time pricing in the wholesale market are understudied. Part of the lack of research can be attributed to electricity's status as a non-storable commodity; market demand for electricity is considerably inelastic, flat rate design while there is real-time variability in supply and demand (Newell et al., 2014). In this study, we examine the impact of price responsiveness of consumers in the Midwest wholesale market on emissions form three major pollutants of CO_2, NO_x and SO_2 caused by electricity generation in the Midwest ISO market. Our results show significant evidence that an increase in electricity price responsiveness in the wholesale market leads to a decrease in SO_2 emissions; but an increase in CO_2 and NO_x emissions from electricity generation. However, during peak hours, we found that a percent increase in real-time prices is associated with a decrease in emissions from CO_2, NO_x and SO_2 pollutants: a 10% increase in the real-time prices is associated with 0.2% decrease in CO_2, 0.05% decrease in NO_x and 0.1% decrease in SO_2 emissions during the peak hours. Our paper contributes to an understanding of the environmental implications of the hourly real-time pricing and identifies the environmental implications of consumers' price responsiveness in the Midwest wholesale market. An important implication of our empirical analysis is that real-time pricing may not offer as clean alternative as expected. For example, our regression results for the Midwest market average including all generator types show that the real-time price elasticity of hourly emissions is positive. However, our work suggests that the impact of real-time pricing on the environment may be different during peak hours, and we find that price elasticity of emissions is in fact negative during peak hours.

5F: Is time on our side? The temporal dimensions of energy conservation

Moderator: Michelle Vigen, Montgomery County

Speaker: Matthew Harding, Duke University

Empowering Consumers through Smart Technology

This paper investigates the extent to which technology used to automate household responses to time-of-use pricing for electricity leads to higher energy savings than simply providing households with information on current prices and quantities. Using a large randomized field trial, we find that informed households with "smart" thermostats achieve impressive reductions in consumption during on-peak periods of up to 60%, but also engage in substantial load shifting to off-peak hours. While this reduces the cost of supplying electricity, it may have negative environmental consequences, since marginal CO2 emissions during the off-peak hours are larger, thereby offsetting the reductions achieved during on-peak hours. We also document the extent to which household responses to time-of-use pricing are heterogeneous and vary significantly by demographics, weather, and across the conditional consumption distribution.

6A: Lightning: Feedback & Information Technologies to Understand and Enable Behavior Change

Moderator: Gene Rodriguez, ICF

Speaker: Lindsay Baker, Building Robotics, Inc

Reconnecting People and Buildings: Comfy Software for Office Temperature Control

In looking at commercial building energy consumption, many of the known opportunities for positive behavior change have been found through turning off lights, turning off plug loads at night, and other similar easy actions for workers to take in their daily routine. But often the largest energy usage in buildings is HVAC- an energy use that is inextricably tied to people and their preferences and behavior. How can we create a system that encourages efficiency and good behavior in HVAC use? At Building Robotics, we've developed a software called Comfy that addresses these issues head on. Comfy is a learning thermostat, which provides a direct connection from the occupant of a commercial building to the building systems. When users click 'Cool my Space', they get a 10 minute stream of cool air directly to their zone. Then Comfy uses these clicks (based on time of day, day of week, indoor/outdoor temperature) to optimize space conditioning, reducing conditioning where it isn't needed. This new technology poses a host of interesting questions that are exactly the type that the BECC community has so successfully tackled- persistence of use, collaboration/sharing, feedback/context for environmental decision-making, etc. In presenting our work with Comfy and the early pilot case studies of its use, we hope to encourage a lively discussion of where this new innovation can go in reconnecting people to their workplaces in a positive and satisfying relationship. We will also address the underlying thermal comfort principles associated with office comfort and the long and short term nature of satisfying people in shared environments. Modern internet-based, mobile-ready technology allows us to provide much more granular and dynamic services to people, including comfort in offices. With Comfy, we do this in 2 ways. First, with machine learning (also referred to as artificial intelligence), which allows us to provide dynamic environmental conditions, without taking the time of the facility manager. Equally critical is great user experience, which allows us to incorporate the intelligence and needs of real people, however unpredictable, while being simple, delightful, and sticky. In this talk, we propose to share the vision and framework for a system that needs both real people and machines to work together to produce great environments for people that reduce unnecessary HVAC use. We hope to inspire others to think of ways to use people-centric, machine-learning-based technology to solve environmental problems while helping people in their daily lives.

6A: Lightning: Feedback & Information Technologies to Understand and Enable Behavior Change

Moderator: Gene Rodriguez, ICF

Speaker: Gerry DeSeve, ICF International

Energy Mapping: Making Complex Energy Data Easy To Understand

Finding detailed electricity usage data is no longer a challenge – but making sense of it still is. This session will introduce two case studies on how large volumes of commonly available electricity data can be visually represented for analysis using simple tools built into Microsoft Excel. The case studies show how this innovative approach was used for analyzing electricity use at a 110-building campus in support of an energy master plan, and to demonstrate the efficacy of a building-wide lighting controls system at a state-of-the-art healthcare facility. Managers in energy efficiency and sustainability often have difficultly presenting energy information to decision makers. Getting the data is easy enough: many electric utilities have embraced big data and provide Web access to key energy metrics. But the data is undigested. And, when pumped out in its raw form, it is indecipherable. So how can the wealth of available data be used to effectively tell a story, facilitate discussions, and enable effective decision making? One answer is to literally paint a picture. Using commonly available interval data - snapshots of electric use taken every 15 minutes - and standard Excel formatting, analysts can assign a color to each interval. The color represents the intensity of the electricity use during an interval: high usage intervals become red and low intervals become blue. And, with a simple formula, the change in use from interval to interval can be established – and the resulting value can be formatted to show when use is increasing or decreasing. These usage pictures – or "energy maps" – immediately tell stories. More importantly, the pictures make it easy for non subject matter expert decision makers to understand a large dataset. Once this understanding takes place, decision makers can begin to ask questions and drive analysis. This typically takes place when someone looks at a strangely colored area and asks: "What happened here?!?" The first case study shows how this approach was used at a large state-of-the-art healthcare facility. The customer had applied to their utility for an energy efficiency incentive for lighting controls. But the application was rejected: the customer had no way of demonstrating that the system met the program's eligibility requirements. Using an energy map, the customer was able to visually show when and how the system was reducing usage. The incentive was paid. The second case study shows how the approach was scaled to cover 110 buildings to support the creation of an energy master plan. This energy map combined interval data from multiple meters with weather data. The result was a map that showed in detail how and when the campus consumed energy: when buildings turned on their HVAC systems, when people arrived, and the relationship between heat, humidity and energy use. Attendees will gain an understanding of exactly how to create energy maps using their own data, as well as how to use the maps to begin a dialog about lowering energy use and reducing greenhouse gas emissions.

6A: Lightning: Feedback & Information Technologies to Understand and Enable Behavior Change

Moderator: Gene Rodriguez, ICF

Speaker: Gayle Bodge, Gulf of Maine Research Institute

PowerHouse—Student-Driven: Real-Data, Real-Time, Real-Change

PowerHouse, a Gulf of Maine Research Institute (GMRI) classroom education program, engages students and their families in real-world science and mathematics investigations using their personal home electricity data from Central Maine Power (CMP) smart meters. GMRI has worked closely with Maine's educators to design and deliver the PowerHouse platform, program, and quality professional development. Educators are engaging students in interpreting home electricity data, conducting investigations about how electricity is used, and exploring strategies for managing home electricity use. Through the PowerHouse online learning platform, students engage in peer-to-peer learning by sharing investigation results, tracking savings, and commenting on challenges and questions posed by the community. "Powerhouse is engaging my students in relevant science and math content while hooking their families into the conversation of energy use in homes," said Jennifer Galasso, 8th grade science teacher at Bath Middle School. "This is cutting edge work!" PowerHouse has two goals; to deepen math and science learning and reduce Maine's carbon footprint. To relate global issues such as climate change to choices made on an individual level, PowerHouse provides students with the total carbon output resulting from the fuel mix needed to generate their electricity. Electricity and carbon data can be viewed on hourly, daily, monthly, and yearly scales. Using this data, students can make informed decisions about how they use electricity at home and when they choose to use that electricity. Equipped with rigorous data and analysis tools, students become a driving force in reducing their household carbon footprint while gaining relevant skills in science, technology, engineering, and mathematics.

6A: Lightning: Feedback & Information Technologies to Understand and Enable Behavior Change

Moderator: Gene Rodriguez, ICF

Speaker: Danielle Sass Byrnett, U.S. Department of Energy

Discover the new DOE Residential Program Solution Center

The U.S. Department of Energy Better Buildings Residential Program Solution Center – being released in October 2014 – is an online collection of proven residential energy efficiency program examples, templates, tips, lessons learned, step-by-step suggestions, and other resources. This free, one-of-a-kind tool can help programs quickly adopt proven innovations, minimize trial and error, and achieve success throughout a program's phases, including planning, implementation, management, and evaluation. Content topics include business models, program integration, marketing and outreach, contractor engagement, workforce development, financing, and evaluation and data collection. The Solution Center is applicable to a wide-range of residential energy efficiency programs. The presentation will explain the Solution Center's functionality and content and how program administrators and other users can use the information to help design, implement, and evaluate residential energy efficiency programs.

6A: Lightning: Feedback & Information Technologies to Understand and Enable Behavior Change

Moderator: Gene Rodriguez, ICF

Speaker: Ian Rowlands, University of Waterloo

Financial Incentives and Residential Energy Management in Ontario

An engaged residential customer base is a necessary, though not sufficient, condition for progress towards a sustainable energy future. Householders will become more active consumers (and eventually 'prosumers') if they are provided with actionable information, the means to control outcomes and economic incentives. A pilot project in Milton, Ontario (Canada) has explored further this supposition. More specifically, households were equipped with advanced energy management technology, a webportal to access information and financial rewards if they participated. Twelve households accepted the offer, inputted their energy management preferences (in terms of acceptable temperature ranges and temporal windows of operation for their appliances) and then proceeded to let the system manage their comfort. Participation occurred across the 2013 and 2014 summer cooling seasons (primarily June-August in Ontario, Canada). It is anticipated that, in total, data from 300 household-days will be available for analysis. To provide an illustration of the kind of data that will be presented and analyzed, consider the following results from one household's experience during summer 2013. Wednesday, 26 June 2013 and Wednesday, 10 July 2013 were similar days in southwestern Ontario – at least in terms of weather (maximum outdoor temperatures of 28.9°C/84.0°F and 29.2°C/84.6°F, respectively, with average relative humidity values of 90.8% and 94.5%, respectively). They differed, however, in terms of how the air conditioning system was managed in this particular home. On 26 June, the household occupants used their thermostat as a conventional programmable thermostat. On 10 July, by contrast, the thermostat responded to the householder's constraints – that is, it acted upon the results of a model's calculation to ensure that user-inputted permissible indoor temperature ranges were achieved at different times during the day. For instance, this householder set a range of 22.5°/72.5°F-26°C/78.8°F during their sleeping hours and 23°C/73.4°F-27°C/80.6°F during the middle of the day (9am to 5:45pm). Thus, not surprisingly, this householder prefers slightly cooler temperatures during sleeping hours. Those ranges were indeed maintained, with an average indoor temperature of 24.3°C/75.7°F. What was also different was the amount of electricity used by the air-conditioner in this particular house: on 26 June, the day in which it worked to maintain a particular temperature (as indicated by the dial on the thermostat), it consumed 10.4 kWh; on 10 July, the day in which it drifted within a user-set permissible range, and thus strived to minimize energy costs while maintaining prescribed comfort levels, it consumed 8.3 kWh. This represents a reduction of 20%. A full analysis of all households' results will provide a better indication of the extent to which user-mandated controls can allow technology both to meet householders' demands in terms of comfort and to reduce energy consumption in terms of kilowatt-hours, costs and carbon emissions.

6A: Lightning: Feedback & Information Technologies to Understand and Enable Behavior Change

Moderator: Gene Rodriguez, ICF

Speaker: Kan Takeuchi, Hitotsubashi University

Eyetracking on HEMS monitors: What do users see for energy saving?

This study examines the eye movements of HEMS users by eye-tracking and investigates the relationship between how they reduce the energy usage of their households and what they see on their HEMS monitor. Eye movements are, in general, highly correlating with one's attention and characterize her/his own cognitive process during information search or decision-making. Thus I collect energy usage data, access log to the HEMS and eye-tracking data of the residents of Energy-Smart home in Japan. The data identify what piece of information on the screen of their HEMS tablets correlate with their energy saving behavior. Furthermore, I explore for the effective factors of the interface that enhance the desirable behavior. HEMS are widely implemented for energy saving, though the interfaces, i.e., HEMS monitors, vary among systems. Some show the level of the current energy usage on the top screen, and others display the inflow, and the outflow if any, of electricity to the household. We know, however, almost nothing on how the users perceive those pieces of information and how their perception might change their behavior. As the eye-tracking technology has been opening the "black box" of such cognitive process in many research fields, I employ eye-tracking on HEMS users. The contributions of this research are the following: 1) to identify the efficiency of each piece of information on energy usage in terms of energy saving behavior, and 2) to provide benchmark data for a better HEMS monitor interface design.

6A: Lightning: Feedback & Information Technologies to Understand and Enable Behavior Change

Moderator: Gene Rodriguez, ICF

Speaker: Mary Zalesny, Pacific Northwest National Laboratory

Behavior Change for Energy Conservation

Research on the performance of green buildings in recent years has placed greater emphasis on the roles of occupants and others who have the potential to influence how well the buildings work. Public and private organizations recognize that technology solutions alone may not achieve the ambitious energy or water reduction goals set by some federal agencies and that using less energy should be the first goal of any plan to improve energy performance. Pursuing both behavioral and technology modifications to building systems improves the opportunities for energy savings and the likelihood that energy goals will be achieved. A demonstration project with the Department of Defense in five green buildings on the Fort Carson, Colorado, Army base was conducted to understand the potential for institutional and behavioral change to enhance building performance. The research team identified specific occupant behaviors that had the potential to save energy in each building, defined strategies that might effectively support behavior change, and implemented a coordinated set of actions during a three-month intervention. The most dramatic change was an increase in energy saving behavior compliance (shutting down computers at night) from 8% to 59%, with average building increases in compliance ranging from 13% to 51%. Analysis of metered energy use data from one building suggested these measures led to at least a 2% reduction in energy use after three months. With full compliance over time, savings from these two measures alone are estimated to be 3-7% of the building's energy use. The study provides lessons learned about energy use change on military installations and suggests several implications for programmatic approaches to sustained institutional and behavioral change including having an engaged local advocate, regular information sharing and feedback to occupants and their managers, and suggested changes in behavior when desired energy saving actions are not being followed. Although not as impactful as an engaged local advocate, communications from supervisors were influential in changing some energy use behaviors.

6A: Lightning: Feedback & Information Technologies to Understand and Enable Behavior Change

Moderator: Gene Rodriguez, ICF

Speaker: Kira Ashby, Consortium for Energy Efficiency

Connecting Behavior Change to Energy Savings

6A: Lightning: Feedback & Information Technologies to Understand and Enable Behavior Change

Moderator: Gene Rodriguez, ICF

Speaker: Magali Delmas, University of California, Los Angeles

What Can We Learn from High Frequency Appliance Level Energy Metering? Results From a Field Experiment

As smart meter technology becomes increasingly common across the United States, questions that were previously impossible to answer are now within reach. In this paper, we use cutting edge field experiment techniques based on high frequency appliance level electricity consumption data to answer questions that have implications for consumers, policy makers, and public utilities but have not previously been addressed due to technology and data limitations. We address the following questions: which individual appliances are contributing to peak demand usage? How much variation is there in the electricity usage of similar appliances across different types of households? How much energy savings can be achieved through the installation of new appliances? How do decreases in usage due to technological change compare to reductions from behavioral interventions? Our study answers these important questions based on 1,085,377 hourly observations over 24 months for 129 similar sized apartments with similar appliances (refrigerator, heating and cooling, dishwasher, lights and plug load). First, we find that there is significant variation in appliance level electricity consumption across households living in apartments of similar sizes and layout, and equipped with identical appliances. Users in the 75th percentile use up to three times more than users in the 25th percentile for heating and air conditioning. Second, we observe electricity usage through the day and we find that non-HVAC loads makes up a significant share of peak demand electricity consumption. Third, we combine our electricity data with demographics for each participant in the study to see how electricity usage varies across household types. We find that households that are members of environmental organizations use significantly less HVAC. Lastly, we take advantage of the installation of new refrigerators in a subset of our monitored apartments to determine the electricity savings due to the installation of a new major appliance in a real world setting. We find that the savings from installing a new refrigerator reduce energy consumption by only 5% for the typical household in our sample.

6B: Segmentation--Marketing

Moderator: Christina Nichols, US DOE

Speaker: Kenneth Gillingham, Yale University

Determinants of Word of Mouth in Solar PV Adoption

This study performs a set of randomized field experiments varying central tenants of a well-known behavioral intervention that traditionally combines a single community-chosen installer, group pricing, and community-led outreach via word-of-mouth (WOM) to promote the adoption of solar photovoltaic (PV) systems. This intervention, the "Solarize Connecticut" program has been demonstrated to be effective in substantially increasing the rate of solar adoptions in participating communities (Gillingham et al. 2014). The treatments in this study were chosen to uncover the dynamics that ensure the programs' success by testing particular hypotheses about the key features of the program. The successful Solarize model in Connecticut (CT) involves an intensive, twenty-week campaign. A single, competitively-selected solar installer is chosen by each municipality participating in the program, and community volunteers conduct solar education activities and recruit homeowners to sign contracts with the solar installer. The installer in turn offers a set group buy for the entire program: the more homeowners that sign a contract, the lower the price per watt for all participants. We test two treatments to better understand why and how the Solarize model works. Our first, "Solarize Express" is motivated by the observation that a very large percentage of the Solarize contracts tend to be signed in the last few weeks of the program. This suggests that the impending end of the campaign is salient to consumers. We predict that a 13-week campaign would reduce the program costs without substantially reducing the number of contracts signed. Our second treatment, "Solarize Choice" is motivated by the belief of many community leaders that having a single chosen installer reduces consumer choice and competition. Such a competition effect could occur since once an installer wins the bid to be the designated installer, it is difficult for other installers to enter. We hypothesize that having several installers increases the competitive pressure, leading to lower prices. We also hypothesize that without a group buy, we may see lower installer marketing efforts, less overall WOM, and more contractor-specific WOM, leading to a lower rate of installations. Accordingly, our treatment allows for two to three community-chosen installers, which are not required to provide group pricing. We randomly assign 21 communities to each of the treatments, which ran from winter 2013 to April 2014. During the trials, we quantified a series of metrics documenting all aspects of the programs. After the trials, we surveyed adopters, interested non-adopters, and other community members, quantifying their preferences and rationale behind their decision. Our results provide insight into the mechanisms underlying the success of Solarize. The classic programs during this time period were similarly effective at increase solar installations as previous Solarize rounds. The Solarize Express trials began slowly, but by three-quarters into the round out-paced the classic programs. However, the final numbers for Solarize Classic exceeded that for Solarize Express by roughly a third. The Solarize Choice towns also began slowly, but increased significantly in the last weeks of the campaign. These results have important implications for community-based social marketing programs.

6B: Segmentation--Marketing

Moderator: Christina Nichols, US DOE

Speaker: Ellen Steiner, EMI Consulting

User Research – Maximizing Behavior to Increase Program Effectiveness

The energy industry for its entire history has been defined by the central premise that demand will continue to grow. However, this premise no longer necessarily holds. A number of electric utilities across the U.S. now face markets with diminished demand growth. In addition, after years of falling or nearly flat aggregate costs to deliver DSM in the U.S., utilities are now seeing rising costs to deliver DSM. These rising costs are in part due to the fact that as the most accessible measures are captured, additional savings become more expensive as program designs increase in complexity to deliver deeper savings or broaden customer participation. Given these trends in the industry, maximizing customer behavior and choice in all DSM programs, not just "behavior programs" is essential to increasing impacts and efficacy of energy efficiency programs. Utilizing utility case studies, this presentation will provide conference attendees with an overview of user research and its corresponding benefits; 2) a discussion of when user research is appropriate; 3) lessons learned from conducting and analyzing user research; and, 4) examples of the impact these studies have had on program design, program refinement, and business case development. This presentation will present case studies of user research conducted over the past two years including web and tool usability studies, ethnographic studies, diary studies, and choice modeling studies. Effective, usable design is central to the success of utility web and tool offerings, whether focused on cost savings through customer self-service, helping trade allies calculate potential lighting rebates, or in sharing energy usage data through Smart Grid portals. Given the proliferation of Internet usage, it is essential that utilities have effective websites that are user-centric. Ethnographic studies use observational research methods to understand how a person interacts with and thinks about a widget, whether focused on how users think about their heating choices when they have a ductless mini-split heat pump installed or how users interact with an advance power supply when using their home entertainment system. Where traditional methods ask respondents to show or tell what they do with a widget or their opinion of a widget, a trained observer can often see actions or notice patterns of which the respondent is unaware that more fully explains respondent behavior or satisfaction level. These types of studies, coupled with diary studies in which respondents are asked to track their decisions and the triggers for these decisions, can lead to more effective program educational and marketing materials as well as overall better program designs. Choice modeling encompasses a set of methodologies to simulate real-world consumer purchasing behavior. Choice modeling can help programs understand how people go about making decisions, providing critical information on the trade-offs they make and quantifying the value they place on certain aspects of the decision. This type of information is helpful for designing programs to maximize customer participation and engagement.

6B: Segmentation--Marketing

Moderator: Christina Nichols, US DOE

Speaker: Julie Hayes, Milepost Consulting, Inc.

New and Improved! How integrating proven consumer science and energy efficiency behavior change best practices can stack the odds for successful program design.

Consumer products companies don't assume anything. While "Tide with Bleach" might sound like a good idea, no such product hits the shelves of your neighborhood supermarket without mountains of market research and extensive testing with consumers. These companies want to know that the product will be successful long before the first shipment goes out. They use this market research to inform marketing strategy, sales and product life-cycle projections. And they have been doing this successfully for a very long time. The team at Tradewind Group has more than 40+ years of experience doing this exact market research for companies like Proctor & Gamble and Disney. Milepost has a 17 year history of working closely with utilities on stakeholder engagement, communications and program design. They came together to support TVA on the design of a new residential weatherization offer. Tradewind conducted the market research for the first offer, Energy Right Solutions' In-Home Energy Evaluation (IHEE) pilot, launched in 2009. 55,000 audits later (at an implementation rate of 70+%), it was clear that customer focused market research was paying off. TVA then wanted to add a customized home energy scorecard to the offer. Milepost was engaged to enroll key stakeholders in the development and design of a scorecard that met the specific criteria of homeowners in the Southeast. Data analysis, process evaluation, customer surveys, message testing, focus group sessions and stakeholder workshops informed every decision and resulted in a visual and conceptual design that is now known as eScore. eScore is a customer centric product that provides homeowners with a simple, affordable, 1 – 10 path to making their home as energy efficient as possible, over time, at the pace they can afford. At the time of the writing of this abstract, eScore is piloting on Memphis, TN and available to homeowners through 6 Home Depot stores in Memphis. But eScore is launching with 6 more local power companies, including Nashville Electric Services and Knoxville Energy Board in August 2014 and is scheduled to roll out to all interested local power companies (125+) across TVA's 7 states on December 1, 2014. We will share how integrating the quantifiable value of consumer product development methodology and best practices for energy efficiency can set your program design up for the best possible outcome. Learn how consumer driven, products and services businesses develop products customers really want using highly proven research and testing methodology that results in a solid data-based approach to product design. Milepost Consulting and Tradewind Group team up to show you how this proven process is working for energy efficiency program design and will highlight TVA's eScore pilot as the case study.

6B: Segmentation--Marketing

Moderator: Christina Nichols, US DOE

Speaker: Michael Zeifman, Fraunhofer Center for Sustainable Energy Systems

I know what you did last summer (wanted to save energy): smart meter data accurately predict household intention to enroll in energy efficiency program

Opt-in behavioral energy efficiency and demand response programs require consumers to enroll. Conventionally, households are recruited to participate in these residential programs without regard to consumers' propensity to enroll. Since the fraction of successfully recruited households is usually low, significant resources are wasted on recruitment efforts. Moreover, recruitment within a sub-population that is likely to enroll could be made more effective by targeted marketing. Another application of the propensity to enroll paradigm is elimination of selection bias in control samples used to evaluate savings. Anecdotally, the households that opt-in to behavior-based energy efficiency programs have common attitudes toward energy, i.e., they want to save energy. Estimation of these attitudes using measurable household characteristics (e.g., age, household income, education, presence of children) appears to be a formidable task. Unsurprisingly, the accuracy of the conventional methods (e.g., multivariate logistic regression) for enrollment prediction is just slightly better than 50%. Moreover, the required household data are not freely available to utilities/ program contractors. In this talk, we will show how high-resolution household smart-meter data can be used for prediction of household's propensity to enroll. We will present results of our study of a behavior-based energy-saving program in which the only available household characteristic was hourly electricity consumption data. Using advanced machine learning algorithms, we could predict if a given household would be likely or unlikely to enroll with an unprecedented accuracy of about 90%. This finding opens up a new class of opportunities in energy efficiency.

6C: Games & Gamification

Moderator: Raj Shukla, Cool Choices

Speaker: Carleen Cullen, Cool the Earth

Climate is not a game! 500 million app users ready to play, ready to change.

According to the IPCC, we have 15 years to take serious action to avert the worst of the climate crisis. Therefore, for behavior change to relevant, it must be deployed rapidly and in a scaled environment. No better marketplace exists than that of mobile applications, experiencing a massive technology migration from TV and Web to mobile applications and growth from 2.5b in sales in 2010 to $25b in 2013. Games represent 43% of the total usage, and importantly, many game mechanics mirror well-established behavior change methodologies, providing excellent opportunities in the fledgling field of "games for change." Cool the Earth, a nonprofit with experience of developing successful behavior change programs, is releasing its first in a series of "games for change" apps with a potential market of over 500 million users. Cool the Earth is leveraging the behavior change methodologies and the creative and marketing assets of its national school-based behavior change program that has reached over 250,000 families in 31 states in six years. Recently, researchers performed a year-long, three phase evaluation of Cool the Earth Schools Program, finding its multi-method, multi-audience child-led model to be an effective method of energy behavior change. The study found parent knowledge of the program was high and that parent reports of the nature of child influence were multi-faceted. Cool the Earth Schools is an out of the classroom program empowering K-5 students as the agents of change in their families and communities. Families took the new actions prescribed the program, with over 1/3 of parents surveyed reported taking additional action, including civic engagement. The problem Cool the Earth is addressing is scaling proven methodologies. This summer, Cool the Earth will release its innovative game for change, a gaming app for children employing game design and game mechanics that: 1) engages kids in the climate crisis through an edutainment approach; 2) integrates real world energy energy-saving actions; 3)motivates parent engagement in game and real world actions; 4)builds in persistence of behavior change through gaming techniques; 5)builds direct communication with parents through social media and 6)provides real time analytics. The presentation will focus on the app opportunity including strategic possibilities, key market indicators, advantages and disadvantages of the app marketplace, and marketing and advertising, as well as Cool the Earth's successes and challenges and lessons learned since the summer 2014 release.

6C: Games & Gamification

Moderator: Raj Shukla, Cool Choices

Speaker: Varun Rai, The University of Texas at Austin

Residential EE and Solar Adoption Behavior: An Online Gamification Study

An overabundance of information on energy efficiency and solar energy information permeates the Internet. This complicates a homeowner's attempt to determine what information is actionable, impactful, and applicable for their home and climate. Which rebates are available to them? Of the many possible energy-saving changes they could make, which ones are really worth their time, energy, and effort? Finding answers to these questions can be time-intensive and can yield conflicting information adding to the challenge of building confidence in which actions to take. These uncertainties and non-monetary costs (UNMCs) influence the decision to adopt new behaviors or technologies. To address these UNMCs, we study the use an interactive trivia-style game for mobile devices and PCs to convey information on energy efficiency measures and residential solar photovoltaic (PV) systems. Specifically, we seek to answer the following questions: What is the impact of different methods of information dissemination/presentation on participation, learning, and behavior change? Does increased participation/engagement lead to increased subject knowledge? Does increased knowledge and exposure lead to increased rates of technology adoption, lowered energy use, and/or increased participation in utility energy efficiency and solar PV programs? The data for our study comes from a field program which uses an online gamification platform for information dissemination in the service territories of two electric utilities in northern and central Texas regions. The content of the trivia questions focus on actionable information across three themes: behavioral energy efficiency measures; equipment upgrades to increase energy efficiency; and solar PV systems. The solar portion of the study focuses on developing solar PV literacy, understanding financing options, capturing perceptions of social norms, and countering solar myths. Trivia questions are followed by "insights" and links to additional information, which focus on utility programs and incentives and direct participants to resources, such as do-it-yourself videos hosted on the utility's website. In addition to data collected continuously during the use of the information platform (such as, number of questions played, right vs. wrong answers, additional information sought, utility program page visits and time spent, etc.), pre- and post-surveys are used to capture demographic data, prior attitudes, and changes in attitudes toward energy efficiency and solar PV at key points in the study. We use randomized control and treatment groups of participants to investigate the role of economic versus hedonic drivers to participate, social norms and comparisons, and goal setting to understand what approaches motivate people to learn about and adopt energy efficiency measures and solar PV. Difference in motivational drivers is examined by phrasing the trivia questions to emphasize either economic or environmental benefits. Impact of goal setting is examined by providing individual vs. group goals. Finally, the role of social comparisons is examined via the use of a leaderboard to selectively display individual and other participants' scores.

6C: Games & Gamification

Moderator: Raj Shukla, Cool Choices

Speaker: Kate Farley, ACEEE

Gamification: Behind the Hype

Gamification has the potential to harness the attention of large numbers of people in order to change everyday behaviors. Pure games—that is, games with no specific altruistic motive—can reach millions or even billions of people, particularly when on a digital platform. Angry Birds, the number one downloaded iOS app of all time, has over 2 billion downloads and hundreds of millions of active players. Grand Theft Auto V, the best-selling game of 2013, sold over 30 million copies worldwide across all game platforms. Many games are also identified by their "addictive" qualities, as exemplified by game designer Ian Bogost's infamous Cow Clicker, which showed that with proper game mechanics, people could be incentivized to do even mundane activities obsessively. The ultimate goal for a pro-environmental game is to make engaging in behaviors like turning off lights or using programmable thermostats as addictive and fun as playing popular games. There have been several game pilots that have achieved positive results at small scales. We have developed a database of existing programs in the energy and environment space that use game mechanics. We plan to identify specific elements of gamified programs that successfully promote pro-environmental actions among a target audience. Our primary criterion for success of a program is participation rate. Essentially, are the games fun, and will people actually play them? Only after realizing a critical mass of players will any other metrics, such outcomes as "energy saved" be measured. What would a world look like where people recycle with the same enthusiasm as reaching the next level in Candy Crush? Or collaborate with co-workers to develop a workplace energy plan with as much focus as a World of Warcraft raid team fighting a dragon? By making relatively mundane activities "fun," gamification can, in theory, make such a world possible. Gamification is the use of game mechanics to encourage real-world behavior change. It is perhaps best-known in the business world as a tool for marketing and promoting worker productivity, but it is also beginning to receive a great deal of attention for its ability to promote altruistic behavior. Our goal with this presentation is to cut through the hype surrounding gamification and make it a useful tool for energy efficiency and environmental program design.

6C: Games & Gamification

Moderator: Raj Shukla, Cool Choices

Speaker: Sandra Burri Gram-Hansen, Aalborg University

From traditional e learning to location based gaming – The engaging climate and environment tutorial

The engaging climate and environmental tutorial, is a location based educational game, developed by the Danish Military defence, as part of the large scale project Green Military Establishments. Energy consumption and environmental issues are already fully integrated themes in the curriculum of Danish soldiers, when they begin their military education. Traditionally, the soldiers have completed an extensive e-learning session in both environmental and energy related matters, however experience show that whilst the course covers all the required content, the soldiers struggle to connect the course material to their actual work practice. What is learned while seated in front of the computer is not necessarily put to practice outside and as a result, use and maintenance of buildings and military establishments remains an extensive amount of the collective energy consumption within the Danish Military Defence. As part of large scale initiative to motivate a sustainable behaviour change amongst not only the soldiers in training, but also the employees serving on long term contracts, a pilot study is now exploring the potential of location based gaming as an alternative to traditional e-learning. The design of the game is based on a cross field between gamification, multi modal communication and persuasive design, and aims to teach the soldiers what they need to learn, when they are at the location where they are expected to behave in a specific way. In the game, the soldiers are sent orienteering, and presented with information and different tasks once they reach the different locations. The aim is to draw upon persuasive principles such as competition and conditioning and to make the information more relevant and applicable by allowing the learning to take place in a location which better facilitates the intended learning outcome. The approach taken to persuasive design in this case is highly linked to the rhetorical notion of Kairos, which refers to the opportune moment as a three dimensional concept that includes the appropriate manner, time and place for an action to take place. Whilst traditional e-learning holds great potential in terms of meeting the appropriate manner requirement, it does not necessarily accommodate the timely and location oriented dimensions of Kairos. Furthermore, traditional e-learning most often allow very little user engagement compared to more constructivist learning approaches. Although the game is developed within the Danish Military Defence, the ground elements of actively using different locations as part of the persuasive mediation process is already acknowledged and is often referred to as mobile persuasion. The results present from this pilot study are expected to be of benefit in a range of persuasive learning scenarios, as the content of the game may be changed without imposing a conflict towards the behaviour changing potential of the game.

6D: Identifying & Overcoming Barriers

Moderator: Wes Shultz, Cal. State University, San Marcos

Speaker: Scott A. Robinson, The University of Texas at Austin

Role of Information and Incentives in Technology Adoption: Household-level Predictive Modeling

Full abstract with figures sent to: samb@caenergy.com Electric utility programs to encourage the adoption of low-carbon technologies by customers often face competing demands on the scale of monetary incentives, timing and nature of information and marketing campaigns, and equality measures (for example, expectations of reasonable adoption in low-income communities). The structure of technology adoption hinges upon individual decision-making, which involves attitudinal, social, and economic components. Together, these components create a system characterized by heterogeneity, complex interaction, and feedback effects, all of which pose difficulties for traditional modeling approaches. In view of these complexities, designing utility programs that effectively address all the demands on utility programs is often challenging. To address this issue, we utilize household-level agent-based modeling (ABM) for a detailed description and study of the complex system that describes the adoption of consumer energy technologies. We use rooftop solar as our empirical test-bed for detailed modeling and validation of our ABM framework. Our ABM framework explicitly simulates the decision-making process regarding the decision to install a solar photovoltaic (PV) system of all 173,466 single-family residential households in Austin, Texas. Through integration with a geographic information system of the Austin area with granular environmental and socio-economic layers, we are able to simulate outcomes over space as well as time with high fidelity. Further, we are able to track the temporal and spatial evolution of household attitudes. This means that while simulating the effect of a policy proposal we can estimate a net change in each area of the city for a given time period. After validating our ABM against actual household-level program data from 2008-2013, we use the ABM framework to explore the effect of different policy interventions, rebate structures, and marketing and information campaigns from the bottom-up. Due to the importance of information barriers to PV adoption, we evaluate the effectiveness of information dissemination campaigns that could be potentially undertaken as part of a utility program. Social network analysis and graph theory literature emphasizes the importance of central nodes in the diffusion of information through a network. We test four centrality measures (degree centrality, betweenness centrality, closeness centrality and eigenvector centrality) and find that because of the localized nature of solar social networks and the interaction between social, attitudinal, and economic variables, the method of selecting the target nodes is a key determinant in the outcome of the information campaign. We also test the effect of tiered rebate structures proposed to correct the potentially regressive nature of solar PV incentives, which tend to be utilized by higher income households. We find that tiered structures can correct this issue, but in locations where attitudes have been `primed'--for example by existing PV adopters in the neighborhood. This suggests that any program to effectively address equality concerns will need to consider both economic as well as informational aspects of the relevant technology.

6D: Identifying & Overcoming Barriers

Moderator: Wes Shultz, Cal. State University, San Marcos

Speaker: Michael V Williams, Wales Behavioral Assessment

Self-efficacy and barriers as mediators of behavioral change

The relationship among individuals' sense of control, environmental opportunity and the implementation of energy improvement programs has been discussed as a potential important relationship. However, direct demonstration of the relationship between this cognitive variable and energy efficient behaviors is sparse. Two moderately recent reviews, one by Woods and Skumatz (2004) and a second by Mayne, Darby and Hamilton (2012) have provided an indication that the variable might be important. In our own experience, we have found that structural barriers and an individual's ability to address them can profoundly affect the success of program implementation. In our work in other settings, the self-efficacy variable is central in its importance as has been reported in the literature. This note reports the relationship among these three issues in the implementation of energy efficiency in a clinical medical facility as a part of a broader program of improving physician engagement. The measure of individual sense of self-efficacy was a short, ten-item scale of general self-efficacy developed by Schwarzer and colleagues. The measure of barriers to implementation was a short, seven-item scale that was purpose built for this study. Each of these measures has been confirmed for structure and together provide indicators of five underlying variables – two self efficacy variables and three barrier variables. In addition, intent to implement was measured utilizing a conjoint analysis including a set of alternative changes to behavior that included energy efficiency behavior as one set of alternatives. Preliminary regression employing simple least-square analysis demonstrated a significant relationship between the barriers construct and the proportional likelihood of choosing energy efficiency as a behavioral change. Specifically, a sense of structural barriers to change is predictive of the formation of an intent to change usage patterns. However, upon closer inspection the barriers constructs appear to mediate the self-efficacy constructs. It appears the relationship between self-efficacy and the formation of an intent to change is related to the participant's sense of the impediment of the barrier at question. This provides an example of a proximal variable that completely masks an important underlying causal relationship in the relationships that ultimately lead to effective energy efficiency improvement through such a program. These findings are noteworthy not only because the study demonstrate that self-efficacy is an important variable but also because it demonstrates the limitation of a standard regression analysis where there is an ordered path of cause. The proximal variable tends to absorb all the explanatory variance while secondary variables may show up as having insignificant coefficients, thus hiding a potentially critical variable in understanding the cognitive processes involved. Thus for example, one may believe that the limitation in the efficacy of an energy efficiency program is that the participant faces insuperable barriers whereas the true limitation may be that potential participants do not view themselves as being effective agents of change. These findings suggest that methods of addressing energy efficiency program participants' sense of self-efficacy may well be important in improving the efficacy of efficiency programs.

6D: Identifying & Overcoming Barriers

Moderator: Wes Shultz, Cal. State University, San Marcos

Speaker: Aurelia Figueroa, German Development Institute

Behavioural Insights for Energy Efficiency in Developing and Emerging Economies

6D: Identifying & Overcoming Barriers

Moderator: Wes Shultz, Cal. State University, San Marcos

Speaker: Constantinos Spandagos, Hong Kong University of Science and Technology

Energy-related decisions in large cities under bounded rationality

The role of energy-reducing and energy efficiency measures in the residential sector is crucial for the successful implementation of regional, national and international climate change mitigating strategies. However, adequate understanding of the acceptance and adoption of these measures is still unavailable. Policy-makers often assume that consumers are motivated only by monetary rewards. While this is true at some level, people very often decide under bounded rationality, allowing various non-monetary factors to influence them. This work aims at investigating the link between such factors and the decisions of consumers to: a) purchase an energy-efficient appliance or not, and b) to follow a high or low-energy consuming lifestyle. In order to characterize different behaviors and to predict how consumers prioritize their objectives regarding residential energy-related decision (with a focus on the use of large appliances for heating and/or cooling), we use a novel agent-based modeling approach, operating under a fuzzy optimization environment. We suggest that fuzzy optimization is a useful tool in describing such decision-making processes. While it is often assumed that humans optimize their decision-making process in order to achieve the best solution among competing goals, this optimization can become "fuzzy" under a bounded rationality regime. Our model is supported by empirical data, collected through web-based surveys from households in American, European and Asian large cities in order to analyze the effects of demographic variables (such as income level) and other country characteristics (such as climate, policies, and education towards environmental awareness). The results indicate the degree to which the energy-related decisions in households are affected by consumer prioritization among monetary goals, personal satisfaction goals and environmental goals, and also by social pressure. Our approach proposes a method of incorporating real social data into behavior-predicting mathematical modeling, and is expected to aid human behavior researchers and governmental organizations to improve long term energy strategies towards mitigating climate change.

6E: Using Evaluation Research & Results to Design Better Programs

Moderator: Annika Todd, LBNL

Speaker: Lisa Skumatz, Skumatz Economic Research Associates

What's the Evidence On Behavioral Program Impacts, Cost-Effectiveness, and Retention?

Behavioral and social marketing programs are becoming increasingly popular, and there is intense interest in performance statistics for these initiatives. This study assembles information on a variety of behavioral programs, and assesses their design from an evaluation point of view, and reviews key performance data including: impacts, cost-effectiveness, and any available information (admittedly thin) on retention of the behavior change and savings to identify early trends and patterns based on program design. This study presents the results of five behavioral program evaluations, providing information on design, impacts, and cost-effectiveness – and retention of the behavior changes where that is available. The project puts the results of the individual programs in context, comparing to published results on similar types of programs. The highlighted programs include residential (three types), student / university, and military implementation of behavioral change. The work includes projects from different regions of the country. The program evaluations were grouped into types to look for similarities and differences in performance, and factors that seemed to drive higher performance from the programs are highlighted. Strengths and weaknesses of the evaluations are also provided. Performance results from different types of behavioral programs are provided and reviewed to identify ranges of impacts and cost-effectiveness by type of program and sector. Patterns in expected performance associated with different types of programs are identified, and "best" performance drivers are highlighted. Available data on persistence of the behaviors / savings are provided, along with lessons from the program and evaluation designs used to date.

6E: Using Evaluation Research & Results to Design Better Programs

Moderator: Annika Todd, LBNL

Speaker: Marcel Harmon, M.E. GROUP

"Irrational" Vs. "Rational" Behavior: Using Evolutionary Theory and Comprehensive Evaluations to Ensure Building Performance Meets Design Intent

Psychologist Kurt Lewin once described behavior as a function of the individual and the environment. Expanding on this, individual and collective behaviors can be seen as focused on meeting individual and group needs within a given social/cultural and physical environmental context, needs which are shaped by human physiological, psychological and social/cultural factors. And behaviors that are sometimes classified as "irrational" in the narrow economic sense of the word can be quite "rational" if examined using a different set of parameters. For example, an individual's clothing choice may seem completely "irrational" if the clothing lacks sufficient insulation to keep the individual warm in an over-cooled space, particularly if a space heater (and additional energy) is subsequently used to maintain thermal comfort. But this behavior may be completely rational when considering the use of clothing to signal group identity, status, sexuality or to conform to other norms of dress. An evolutionary multi-level selection (MLS) framework may be a more useful way to frame this. Whether or not the choice of clothing is "functional," "non-functional," or "neutral" depends on who the subject is (the individual or a larger group), and with respect to what (individual reproductive success, group unity and longevity, etc.). Clothing choice may be functional with respect to signaling individual status but the choice combined with space heater usage may be non-functional with respect to an organization's efficiency/longevity (via productivity and utility costs) and societal efficiency/longevity (via greenhouse gas emissions). So if behavior is a function of the individual/group and the environment, the creation of truly sustainable, productive and healthy environments requires an understanding of how the relationships among individual/group behavior, their needs and the physical/social/cultural environment play out contextually on a project by project basis. Otherwise alignment won't be achieved between the plethora of goals and needs of the various individuals and levels of groups involved, from occupants to O&M staff to building owner to the community at large. Without alignment, building performance and occupant productivity and health suffer and do not meet design intent. The only way to achieve alignment is to a) thoroughly engage the key stakeholders involved (including the occupant) from master planning through occupancy and b) comprehensively evaluate built environment experiments after occupancy to verify what's working, what isn't and why, so adjustments can be made to existing facilities and their operations and organizations, as well as apply the lessons learned to future projects. In this paper I will a) examine behaviors within the built environment from an MLS perspective and b) discuss methods for comprehensively evaluating building/occupant interrelationships, drawing from multiple master planning and post occupancy evaluations (POE) case studies from Kansas, Missouri, New Mexico and New York. As buildings are responsible for as much as a third of global greenhouse gas emissions (and that percentage is greater when considering industrialized nations only), ensuring that facility performance meets or exceeds design intent is a necessary and critical component of addressing climate change.

6E: Using Evaluation Research & Results to Design Better Programs

Moderator: Annika Todd, LBNL

Speaker: Josh Schellenberg, Nexant

Research Design and Evaluation of Southern California Gas Company's Conservation Campaign

In 2013, Southern California Gas Company (SoCalGas) conducted a large-scale rollout of advanced meters and launched its conservation campaign. The conservation campaign featured a controlled launch of various behavior change mechanisms, including opt-in and default bill alerts and home energy reports (by mail and email). Among the over 550,000 residential customers that had advanced meters as of September 2013, the population was randomly divided into 12 treatment and control groups. The evaluation estimated and compared the gas savings associated with each behavior change mechanism and demonstrated how SoCalGas was progressing toward its conservation campaign goals. The research design and results of this study are highly pertinent to the many utilities that are looking for innovative ways to produce energy savings and identify the most cost-effective behavior change solutions. The SoCalGas conservation campaign also provides a valuable case study of how utilities can implement behavior change programs in a strategic way that allows the utility to claim energy savings and continuously improve toward more cost-effective solutions.

6F: Behavioral Economics & Decision-Making in Transportation Sector

Moderator: Shruti Vaidyanathan, ACEEE

Speaker: Allen Greenberg, U.S.DOT/FHWA

Challenges and Opportunities in Incorporating Behavioral Economics in Vehicle Use and Parking Pricing Pilot Deployments Under the Value Pricing Pilot Program

The Value Pricing Pilot Program (VPPP), which has been funded out of the Federal highway trust fund at $12 million per year through the end of FY 2012, and for which many new projects are just getting started, supports cutting-edge transportation pricing pilot projects entailing tolling and non-tolling pricing strategies. Various innovative non-toll pricing strategies are being tested under the program related to usage-based auto insurance, variable and transparent demand-based parking pricing, and new forms of vehicle-use pricing and services (including car sharing of many varieties and priced dynamic ridesharing). This presentation would feature multiple examples of innovatively designed non-toll pricing implementation studies that incorporate behavioral economics, and would report on results for studies that have been completed or are near completion. One example is a parking pricing project in Minneapolis offering the PayGo Flex-Pass, which allows monthly paying parkers to earn rebates for no-park days, leading to the proportion of driving days declining from 78.5 percent to 56.5 percent. Another parking pricing project, at Stanford University, is using gaming and lottery-style incentives to encourage forgoing parking and remote campus parking, especially on days when interior parking is in highest demand. Examples from dynamic ridesharing (including Carma Corp.) and peer-to-peer carsharing (including Getaround, Inc.) show that strategically targeted but less generous participation incentives can, if paired with other personal motivation strategies, bring about the same level of behavioral change as pricier, less targeted financial inducements. Similarly, benefits in lieu of pricing are being tested in San Diego with a one-way carsharing provider using an all-electric fleet (Car2Go), where free minutes of free carsharing are being offered as an incentive to users to start their trips with vehicles in need of charging, drop such vehicles off at a centralized charging station on their way to their destination, and switch it out with a fully charged car to finish their trip. Finally, while result are not available to report, three pay-as-you-drive-and-you-save (PAYDAYS) insurance projects have been designed very carefully to learn the effects of specific behavioral economics strategies on driving mileage and related decisions.

6F: Behavioral Economics & Decision-Making in Transportation Sector

Moderator: Shruti Vaidyanathan, ACEEE

Speaker: Diana Ginnebaugh, Stanford University

Can Car-Sharing Facilitate a More Sustainable Car Purchase?

Car-sharing is normally seen as an alternative for the car, i.e., a household chooses to join a car-sharing club rather than owning a personal car. However for many households, especially in suburban areas, it is very likely that the option of not owning a car is unthinkable. In this study we explore the idea of bundling car-sharing and vehicle ownership in order to change the consumer behavior of car purchases. The idea is that car-sharing would then function as a substitute for a second car as well as a substitute to some of the services of the main vehicle, allowing for a shift to a more environmentally friendly vehicle such as a smaller, more fuel efficient commuter vehicle or electric vehicle with limited range. We consider the vehicle as a bundle of mobility, comfort, space, performance, symbolic and signaling values. In this case we look at the distinction between "daily use" and "peak use". If the vehicle could be unbundled, the single driver would only invest capital in a smaller, more efficient commuter vehicle while having easy access to vehicles with "peak-usage" features, increasing consumer welfare. In addition, consumer welfare may increase by allowing the consumer greater access to additional features – such as a convertible or performance vehicle – as their needs vary over time. However, the transaction costs of unbundling the complete "daily use plus peak-use" vehicle into a "daily-use" vehicle and a shared "peak-use" vehicle would have to be sufficiently small for most consumers to consider this option, even with capital and operational savings. In the paper we explore what the car sharing service would need to look like for the transaction costs of the service to outweigh the capital investment and operating costs of a bundled vehicle for the consumer as well as explore the readiness of car sharing or rental car companies to provide this type of service. The study consists of three parts: the first being an overview of the related literature on car-choice, bundling and car-sharing. Given the novelty of the field, besides peer-reviewed articles, case studies and reports are included as well. The second part consists of an inventory of available models in car-sharing fleets in the US and Europe in order to assess the availability of "peak-use" vehicles such as 7 seaters, AWD, minivans. We also look at the location of the vehicles from a suburban/urban perspective. In the third part we interview representatives from car-sharing and rental car companies in California and Sweden, as well as some experts in the field. We find that car sharing, as it is at the moment, does not cover the needs for unbundling the vehicle. Most car sharing services today have focused on providing the primary vehicle for people without a vehicle – therefore, most of the vehicles available are smaller, fuel efficient vehicles. However, new business models, such as combining business and private members, or traditional car rental companies joining the car sharing space, may offer the possibility to widen the vehicle models available.

6F: Behavioral Economics & Decision-Making in Transportation Sector

Moderator: Shruti Vaidyanathan, ACEEE

Speaker: Tripp Shealy, Clemson University

Choice architecture in a new domain: applying defaults to an infrastructure-planning tool

Decision tools increasingly guide civil engineers' planning of physical infrastructure systems (e.g., roads, waterways, pipelines, and electricity grids). We evaluate the impact of how decisions are presented, or "choice architecture," in a prominent infrastructure decision tool, the Envision Rating System for Sustainable Infrastructure. The Envision system is used to evaluate, grade and reward projects for meeting sustainability criteria such as reductions in greenhouse gas emissions, preservation of wildlife habitat, and accessibility to community cultural resources. Plans to meet these criteria can receive points in five increasing levels. As currently arranged, projects start with zero points and can earn points by improving upon industry norms. However, by giving points for slight improvements, we find, Envision unintentionally discourages even higher levels of sustainability performance that are possible. Students enrolled in a sustainability construction course at Clemson University used the Envision rating system to make decisions about restoring an EPA Brownfield site. Half of the students received the industry norm default and the other half received a revised higher default. In the revised version, users could lose points for not achieving a certain sustainability level. For example, reducing water consumption by twenty five percent, not one hundred percent, subtracts thirteen from seventeen points rather than adding four to zero points. Our initial findings suggest this higher set default leads to more sustainable design. Currently, we are replicating this study with professional engineers from leading civil engineering firms and the presentation will compare results between groups. To translate this research into practice, we are working with the Institute for Sustainable Infrastructure (ISI) (founded by American Council of Engineering Companies (ACEC), the American Public Works Association (APWA), and the American Society of Civil Engineers (ASCE)), the governing body of the Envision Rating System, to show how choice architecture can improve their system. We plan to leave the audience with the message that tools from the behavioral toolkit, applied during the planning, design and build stages for infrastructure can have major efficiency impacts, shaping the actions of downstream consumers and end users for the lifetime of the infrastructure. These tools can improve the delivery of infrastructure projects at all levels of government and private enterprise and should be of interest to municipalities, city councils, and state and federal departments with responsibilities for building and acquisition (including, e.g. Departments of Defense and Transportation) as well as the private sector.

7A: Lightning: Innovative Behavior Interventions in Different Domains

Moderator: Stephen Bickel, D&R International, Ltd.

Speaker: Salvatore Di Dio, University of Palermo + PUSH

Mobility and behaviours: trafficO2

An accessible and livable city is what we need to guarantee freedom and healthiness for citizens. Today because of cars we are struggling against our historic urban structure and its dimensional constrains. Changing our urban structure to meet the "oil based mobility model" is costly, degrades our environmental heritage, and our precious resources. We need to change mentality towards mobility systems, we simply need to focus and improve "human transit". Why do people move? We move mainly to go to work (to earn money) or to go shopping (to spend money), and by doing that we produce traffic, wasting time, money, health, and resources. So we thought “trafficO2” a social computing project about communities' urban mobility. TrafficO2 is an info mobility decision supporting system that tries to foster a modal split through gaming policies and giving tangible incentives for each sustainable choice. The idea is to match the interests of two complementary actors on the city traffic scene: communities workers (communities that already need a mobility manager) and local business communities (places on the community workers daily paths). The goal is to decrease traffic and pollution creating an equal agreement for both communities: prizes in exchange for a respectful behaviour towards the environment. So, all of the local businesses that belongs to platform (as sponsors) became the stations of a new kind of transport system that foresee only moving by foot, by bicycle, by local public transport and by carpooling. Each trip from station to station gives O2 points to the user, those points are the system virtual money users can collect to get prizes from the sponsors. The aim of the project is to generate a “win-win” situation that creates new city development opportunities just matching the right needs. In June 2012 the project won the Italian Ministry of University and Research Competition "Smart Cities and Communities and Social Innovation" and received 1.2 M€ as co-funding. Initially the project will take place in Palermo (ITA), involving the almost 60.000 users of the University community, the 10% of the city population. According to recent statistics Palermo is the worst city in Italy (and in the European top 5) for urban mobility issues (source TomTom traffic observatory), so it is the right place to test our assumptions. The test of the mobile application (an alpha version with reduced features) has started December 2013 with 100 students selected through a workshop from three different Palermo University departments: computer science, design and marketing communication. The tester choice is motivated by the target selected to address the product: young and curious students are probably the first best social community where experiment behaviours’ changing project driven by social media technologies. This paper aim is to share the practical experience we are doing in Palermo, showing results and data of the first 6 months of our social and technological experiment.

7A: Lightning: Innovative Behavior Interventions in Different Domains

Moderator: Stephen Bickel, D&R International, Ltd.

Speaker: David Roberts, Vermont Energy Investment Corp

Plug-in Vehicles – Measuring and Transforming Consumer Attitudes

Transportation energy use is frequently the single largest source of household greenhouse gas emissions across the United States. Rural settlement patterns found in less populated states, such as Vermont, present challenges to lower carbon travel options. The State of Vermont is promoting innovative Transportation Demand Management (TDM) programs, however walking, bicycling and public transportation are inherently more difficult in rural areas due to longer trip distances and decentralized travel patterns. Plug–in electric vehicle adoption is a strategy that can support climate and energy goals in these areas, particularly as strategic transportation electrification benefits are maximized through off-peak battery charging and renewable energy resources. Electric vehicle ownership can provide considerable lifecycle savings when traveling on electricity instead of gasoline, but the initial purchase price, concerns over limited battery range, general lack of knowledge and other issues are barriers many consumers are unable to surmount when considering vehicle purchase decisions. This presentation will review the accomplishments of Drive Electric Vermont, a public-private partnership working to increase the pace of electric vehicle adoption in the state of Vermont. This work includes statistically valid consumer opinion research on electric vehicle attitudes and awareness in the state, development and implementation of a marketing plan to achieve Drive Electric Vermont goals, and pilot funding for a vehicle incentive program delivered in partnership with auto dealerships. Dealers are frequently cited as impediments to electric vehicle adoption as they are generally less motivated to actively promote electric vehicles due to the amount of time required to educate consumers on the technology and make a sale as well as decreased service revenues due to lower maintenance requirements. Findings from this work will be summarized to allow broad application of successful program design principles beyond Vermont and the plug-in electric vehicle sector.

7A: Lightning: Innovative Behavior Interventions in Different Domains

Moderator: Stephen Bickel, D&R International, Ltd.

Speaker: Jordan DiGiorgio, Center for Sustainable Energy

Electric Vehicle Ride & Dive Campaign - Experience Electric

The San Francisco Bay Area is a regional hub for plug-in electric vehicle adoption, receiving nearly one in three of the California's rebates under the Clean Vehicle Rebate Project (CVRP). In an effort to further accelerate this market and achieve widespread adoption beyond demographic groups commonly associated with "innovators" stage of the adoption curve, the Metropolitan Transportation Commission (MTC) initiated a PEV awareness campaign known as Experience Electric. This effort uses an integrated suite of marketing techniques to increase customer awareness and exposure to electric vehicle technology. A central component of this effort the test drive experience provided to consumers through free, easy to access events throughout the Bay Area. The electric vehicle driving experience embodies elements that are new to most consumers: minimal driving noise, tight handling and instant torque. While this new approach to driving is helping garner rave reviews from drivers, communicating the experience is difficult to capture in a traditional media campaign. As such, the Experience Electric campaign is focused heavily on test drives - getting "butts in seats" - in order to expose potential drivers to the reality of electric vehicles in a concrete, tangible way. Test drive events will take place at workplaces, in sub-urban areas, and in downtown settings. In order to measure the effectiveness of this strategy, pre and post drive surveys are being fielded to participants at the ride and drive events. These surveys provide an opportunity to gauge the impact of the PEV driving experience. The surveys also include data on participant demographics, planned activity in the new car market and, as well as perceived barriers to electric vehicle adoption. These data will be analyzed and presented to show the impacts of ride and drive events as a vehicle for increasing customer acceptance of electric vehicle technology. This analysis provides direct feedback on the effectiveness of the MTC effort, but will also help inform subsequent public investments and guide alternative vehicle promotional campaigns.

7A: Lightning: Innovative Behavior Interventions in Different Domains

Moderator: Stephen Bickel, D&R International, Ltd.

Speaker: Lindsey Maser, City of Portland, Bureau of Planning and Sustainability

How Portland Reduced its Residential Garbage by Nearly 40% While Increasing Compost Three-fold: A City-wide Behavior Change Story with a Plan, a Pilot, and Metrics

In 2011, Portland, Oregon, made changes to its residential garbage, recycling and composting system that decreased residential garbage nearly 40% and produced the highest food waste participation in the country. This presentation will illustrate how behavior change concepts were used throughout the design, evaluation and implementation process. GOALS – The City had three goals: divert 75% of waste from the landfill by 2015, reduce methane by removing food from the landfill, and create a beneficial product (compost). To achieve these goals, the majority of Portlanders needed to change their behavior around food disposal. Instead of putting everything into their kitchen trash, they needed to collect food separately and transfer it to their compost roll cart. PROGRAM DESIGN – The key component was something no other large US city had tried: increasing curbside compost pick-up to every week while reducing garbage pick-up to every-other week. This allowed the City to 1) provide residents an incentive to get the food out of the trash and into the compost, 2) avoid increasing trucks on the road and associated carbon emissions, and 3) keep rates low for residents. PILOT – 2,000 households across four neighborhoods participated in a one-year pilot. The City measured participation rates and surveyed participants throughout the pilot, resulting in improvements to program design and outreach efforts in the citywide implementation. EVALUATION – Focus groups and surveys revealed perceived barriers and benefits, and allowed for testing and refining of messaging. A citywide survey showed satisfaction in waste service dropped and then rebounded a year later. Waste sorts, conducted before and after the program started, assessed the amount of food remaining in the garbage and the amount moved to the compost. Yearly residential waste tonnage reports measured the amount garbage decreased and compost increased. ENGAGEMENT – Education campaigns addressed barriers and highlighted benefits identified by the audience. Promotional materials showed Portlanders sharing the changes they had made in their routines to compost, why they supported composting, and how relatively easy the changes were. Staff and trained volunteers went door-to-door during the pilot and citywide rollout to answer questions. The City hired temporary staff to field questions evenings and weekends to meet increased customer service needs during the first months. REDUCING BARRIERS – Two prominent barriers were identified: 1) residents could not remember which week garbage would be collected, and 2) residents faced a challenge in capturing food from the kitchen and moving it to the cart outside. To mitigate the first issue, the City created a “schedule look-up” webpage and encouraged residents to sign up for weekly email reminders. For the second, free compost kitchen pails were delivered to every household. OUTCOMES – During the first full year, garbage dropped nearly 40% and the amount of compost (yard debris and food) almost tripled. The rate of residential diversion from landfill increased from 51% in 2010 to about 70% in 2012, moving Portland very close to its Climate Action Plan goal of 75% by 2015.

7A: Lightning: Innovative Behavior Interventions in Different Domains

Moderator: Stephen Bickel, D&R International, Ltd.

Speaker: Kevin Luten, Behavior Design Works

Understanding Motivation & Motivational Interviewing

Motivational Interviewing (MI) is a collaborative, conversational technique to elicit and strengthen motivation for change. MI uses four general processes to facilitate behaviour change: • Engaging - used to involve the client in talking about issues, concerns and hopes, and to establish a trusting relationship with a counselor. • Focusing - used to narrow the conversation to habits or patterns that clients want to change. • Evoking - used to elicit client motivation for change by increasing clients' sense of the importance of change, their confidence about change, and their readiness to change. • Planning - used to develop the practical steps clients want to use to implement the changes they desire. MI emerged initially as a treatment approach for problem drinkers. It has evolved over time as a central, evidence-based technique for behaviour change in the health sector, including community-based and workplace wellness programs. With the exception of a few small-scale pilot programs, this technique has not been utilized by the environmental behavior change sector. This presentation will cover the following background concepts related to MI: • Understanding what MI is (and is not), and how it links to other models of behaviour change • Outlining how MI can be positioned as a technique within a larger behavior change program • Delineating how approaches using MI are often fundamentally different than marketing and media-based change strategies (and which approach is best suited to different change objectives) The presentation will also include case examples of three recent behavior change interventions in Western Australia where MI was the central change technique. These projects have targeted changes in physical activity, travel behaviour, and energy and water use, and have included MI conversations with over 12,000 households. The presentation will include the evaluation results from these projects, and discuss cost/benefit considerations of the MI approach.

7B: Policy Drivers for Research into Climate and Energy
Moderator: Jennifer Amann, ACEEE

Speaker: Nathaniel Higgins, US GSA

7B: Policy Drivers for Research into Climate and Energy
Moderator: Jennifer Amann, ACEEE

Speaker: Paul Stern, National Academy of Sciences

7B: Policy Drivers for Research into Climate and Energy
Moderator: Jennifer Amann, ACEEE

Speaker: Stacy Angel, US EPA

7C:The Secret Sauce: Finding and Activating Your Target Audience

Moderator: Katie Mandes, C2ES

Speaker: Ted Peterson, Questar Gas

Unlocking Customer Potential through Data

Nestled in the heart of the American Rockies, Questar Gas, a natural gas utility serves over 950,000 customers. Since 2007, with the approval of a rate-decoupling mechanism, Questar Gas began offering ThermWise® Energy Efficiency Rebate programs. The ThermWise® programs focus on overall usage reduction through rebate incentives for customers engaging in energy efficiency measures ranging from appliance, builder, business, and weatherization measures aimed to improve efficiency and reduce consumption. In its seventh year, as the Energy Efficiency program has moved from its infancy to maturity with nearly 1 in 4 customers having participated in some type of measure, with insulation standing as the most popular, Questar has begun to shift its marketing initiatives and efforts into a targeted approach identifying data and behavior which motivates customers to participate in the programs. In 2010, Questar Gas followed the behavioral trend by creating an internally developed Home Energy Report. This report follows the methodology utilized and highly popularized report in use by other utilities such as SMUD and PG&E. As Questar Gas' Energy Comparison Report has matured and behavioral savings from the report have taken place, continual improvement efforts have occurred. Through two significant modifications, the Company refined its comparison computations and looks and feel of the report. Now Questar Gas is working on its third phased improvement by utilizing a mathematical similarity index patterned after those used by Amazon or Netflix, Questar Gas will launch this improvement to customers in the early Fall 2014. Questar Gas currently sends out home energy reports to over 130,000 customers. Expansion plans to reach additional customers are included in the Fall 2014. With the growing maturity of the rebate programs, Questar Gas looks to better target customers and get to customers who stand ready with the most potential to save. In conjunction with this effort, Questar Gas aims to utilize the similarity index devised and developed by its Energy Comparison Report for marketing efforts associated with targeted efforts to customers. For each measure, the report will run the similarity index for current participants and utilizing that index will utilize identify additional customers. Questar Gas will then subsequently contact these customers directly through email, direct mail, or other targeted means to identify opportunities for these customers. This presentation will highlight Questar Gas' efforts to identify the behaviors of customers, target those customers, and identify the parts in which the Company will continue to improve its efforts to attract customers to participate in Energy Efficiency Efforts.

7C:The Secret Sauce: Finding and Activating Your Target Audience

Moderator: Katie Mandes, C2ES

Speaker: Wesley Schulttz, California State University

Using Social Marketing To Spur Residential Adoption of ENERGY STAR certified LED Lighting

Recent technological advancements in lighting have produced light bulbs that are dramatically more efficient than the traditional incandescent bulb. Contrasted with a traditional 60-watt incandescent bulb, a comparable ENERGY STAR certified LED uses 82% less electricity, produces less heat, and lasts 25x longer. Even compared with CFLs, ENERGY STAR certified LED bulbs are more efficient, longer-lasting, more easily dimmable, and don't contain mercury which allows for easier disposal. Yet despite these benefits, the marketplace has been slow to adopt these newer and more efficient bulbs. To help facilitate this change, the EPA's ENERGY STAR program conducted a series of pilot behavior-change campaigns to encourage residents to purchase and install ENERGY STAR certified LED lights. ENERGY STAR is the nation's premier energy efficiency and conservation program. Founded in 1992, ENERGY STAR was created to "…develop, evaluate, and demonstrate non-regulatory strategies and technologies for reducing air pollution." Today, ENERGY STAR is one of the most recognized and trusted brands in the country, and the ENERGY STAR label has been shown to positively influence consumer purchases. In an effort to support a move toward energy efficient lighting, ENERGY STAR has certified a number of LED bulbs across different manufacturers. In 2013, ENERGY STAR partnered with Duke Energy and Efficiency Vermont to conduct pilot programs aimed at encouraging residents to purchase and install ENERGY STAR certified LED lighting in their homes. The campaigns used Community-Based Social Marketing as the platform for developing the overarching strategy. Building on several recent keynote presentations at BECC and an ongoing series of pre-conference workshops, this talk presents the findings from two ENERGY STAR pilot programs. The campaigns targeted an end-state, nondivisible behavior. Barriers and benefits were identified through a literature review, and through reviews of existing programs and available survey data. The campaigns were developed to highlight the benefits of ENERGY STAR certified LED lights, and to decrease the barriers. In Vermont, a school-based fundraiser was used to promote ENERGY STAR certified LED bulbs, and in North Carolina special in-store lighting events were held at Home Depot and Costco retail locations. Both programs were implemented using a control group, and quantitative outcomes were tracked. Reported results highlight the increase in sales for ENERGY STAR certified LEDs associated with the campaign activities. Survey data are also reported from participants in the two campaigns, along with tests for spillover of the newly adopted behavior into other lighting purchase and behaviors. The lessons learned from these two CBSM pilots are synthesized into turn-key materials that can be adopted by other organizations looking to promote the adoption of ENERGY STAR certified LED lights.

7C:The Secret Sauce: Finding and Activating Your Target Audience

Moderator: Katie Mandes, C2ES

Speaker: Becca Yates, Northwest Energy Efficiency Alliance

Evaluating Marketing Tactics and Consumer Response Within Micro-Targeted Campaigns

Many energy-efficient products provide significant non-energy savings benefits such as increased comfort, health benefits and financial savings. Unfortunately, not all products are created equal in this regard. Some emerging energy-efficient products with the highest energy savings potential in the market today have low consumer awareness and demand, high market adoption barriers and few non-energy saving benefits. These "high cost" products require more nuanced and higher touch marketing strategies to drive response, which can equate to more costly marketing efforts. The Northwest Energy Efficiency Alliance is addressing this dynamic by taking a data-driven marketing approach to move consumers through the purchase/conversion funnel with lowered marketing cost and greater return on investment (ROI). This approach includes: • Tracking consumer movement through identified purchase or conversion funnel stages - awareness, familiarity, willingness to consider, purchase intention - by administering quarterly mass market surveys; • Developing and implementing marketing measurement and modeling strategies for specific marketing campaigns that micro-target likely to purchase or qualify consumers and isolates impact of marketing tactics; • Overlaying marketing interventions, key performance indicators and measurement results over funnel movement to track marketing effectiveness, cause of leakage and ROI of activities over time. In this presentation, NEEA will present preliminary results of a marketing quasi-experimental design implemented in 2014 as part of its Heat Pump Water Heater initiative. This initiative is focused on advancing the adoption of heat pump water heater products that perform well in Northern Climates. These products are most appropriate for specific settings and applications. To ensure successful placement of this product and resulting consumer satisfaction, NEEA is isolating clusters of likely-to-purchase or qualify consumers within zip plus four geographical areas using propensity models. These propensity models leverage housing stock, consumer demographic and installation data and will be used as part of collaborative promotions facilitated by NEEA in partnership with national manufacturers, retailers and Northwest utilities. We predict the findings of this quasi-experimental design will: • Illustrate the positive ROI of micro-targeting high cost products to consumers • Evaluate consumer response to key marketing tactics such as direct mail, shared mail and targeted digital ads to drive consumers through the purchase stages within targeted and non-targeted (control) groups NEEA will use these test results to inform program marketing design, specifically related to marketing tactics used in micro-targeted campaigns versus mass marketing efforts.

7D: Are Smart Thermostats Really That Smart?

Moderator: Jennifer Robinson, EPRI

Speaker: Dr. Lucy Morris, Pacific Gas & Electric

Final Savings Estimates and Key Learnings from a Behavioral Messaging Thermostat Trial

Final Savings Estimates and Key Learnings from a Behavioral Messaging Thermostat Trial The objective of this residential customer trial was to learn about the energy savings from, and customer experience with, a communicating thermostat paired with Opower behavioral feedback software. The one-year trial concluded in February 2014 and found non-significant (at the 95% confidence level) electric and gas savings estimates – lower than the interim estimates presented at BECC 2013. The goal of a BECC 2014 presentation would be to share the "final chapter" of this trial so that utility program managers and technology vendors can understand the final savings estimates and customer experience findings, and benefit from our key learnings around trial methodology and analysis. In a joint effort with several partner firms, Pacific Gas and Electric Co. (PG&E) implemented a trial program in which residential customers were provided with a directly-installed Honeywell programmable communicating thermostat. The thermostat could be remotely managed and programmed through a smartphone app or web portal featuring Opower behavioral messaging that provided customers with instant feedback to encourage more efficient heating and cooling choices. This trial was designed as a randomized controlled trial (RCT), and recruitment was conducted through a "recruit-and-deny" method in which participants were randomly assigned to the treatment or control group after enrollment. Control group customers did not receive a thermostat. Of 693 customers assigned to treatment, practical challenges resulted in 505 thermostats being installed. Recruitment began in July 2011 and was completed in February 2012, when the official trial measurement phase commenced, and ran for one year. Two customer experience surveys were conducted with treatment households, capturing information on: • Whether and how customers used the thermostat, smartphone app and web portal; • How often they interacted with each of the three elements; • How much they liked each of the three elements; • Whether they believe the remote capability and messaging led them to save energy. Because 188 of the treatment households did not have a thermostat installed, an intent-to-treat analysis was conducted of the full treatment group (693), followed by an effect-on-treated analysis of the 505 treatment customers with installed thermostats. Gas and electricity savings were estimated using a fixed-effects panel regression applied to interval usage data from treatment and control groups. Because pre-treatment differences in weather sensitivity were found between the treatment and control groups, a fixed-effect model was applied that allowed for weather sensitivity to differ according to treatment/control status. This analysis yielded 0.7% kWh and -1.4% therms savings estimates (a positive figure indicates energy savings) for intent-to-treat, and 1.0% kWh and -2.0% therms estimates for effect-on-treated. None of these figures is significantly different from zero at the 95% confidence level. It is possible that the technology tested here may have had a small effect on energy consumption, but that the sample size used in this trial was not sufficient to detect it.

7D: Are Smart Thermostats Really That Smart?

Moderator: Jennifer Robinson, EPRI

Speaker: James Stewart, The Cadmus Group

Energy Savings from Connected Thermostats: Estimates for U.S. Homes

This study addresses two questions of interest to policymakers, consumers, and utilities interested in the energy-use impacts of deploying connected (WiFi-enabled) thermostats in U.S. homes. First, what are the potential energy savings from connected thermostats? By allowing users to better match occupancy patterns with home heating and cooling, connected thermostats create opportunity for energy savings. We estimate how much energy could be saved on average if residential utility customers used connected thermostats to optimize their thermostat settings. Second, what are the true savings from connected thermostats? True savings reflect how consumers are actually using connected thermostats. As connected thermostats are a relatively new consumer technology, little is actually known about the energy savings from them. There have been only a handful of pilot studies limited to a few utility service areas that address energy savings. This study relies on two sources of detailed data on space conditioning behavior in the U.S. to answer these questions. First, it uses the 2009 Residential Energy Consumption Survey (RECS), a nationally-representative survey of 12,000 U.S. households that provides information about building characteristics, the amount of energy used for space conditioning, space conditioning equipment, home-occupancy patterns, and thermostat setting behaviors. In addition, the study uses asynchronous user-interface data from about 1,700 Honeywell Total Comfort Connect (TCC) thermostats from across the United States. The Honeywell user interface data cover 13 months and provide information about how consumers use connected thermostats including the interior temperature of the home, thermostat set points, and whether the heating and cooling equipment is switched on.

In the first part of the study, we use the RECS to estimate the potential energy savings from connected thermostats. Using an econometric model derived from a thermodynamic model of home heating and cooling, we estimate the relationship between energy use for space heating and cooling and thermostat-setting behavior. The model results in an estimate of the average home energy savings that would result from setting a thermostat back (forward) one degree during the heating (cooling) season for different U.S. climate zones. We then used this result to estimate the potential energy savings that could be achieved through changes in thermostat setting behavior. An interesting outcome of the model estimation is an estimate of the average efficiency of home heating and cooling. In the model, efficiency depends on the fuel efficiency of heating and cooling equipment, envelope insulation of homes, and air infiltration. In the second part of the study, we estimate the average energy savings from connected thermostats for different U.S. climate regions. We do this by comparing thermostat setting behavior between homes with connected thermostats and those with conventional programmable or non-programmable thermostats. The TCC user interface data provide information about thermostat-setting behavior in homes with connected thermostats, while RECS provides information about thermostat-setting behavior in typical American homes before the introduction of connected thermostats. To ensure the comparability of homes with and without connected thermostats, we employed a matching procedure (Coarsened Exact Matching) that identified RECS homes with geographic locations, demographics, and home characteristics similar to those with connected thermostats. We used these similar RECS homes to establish baseline thermostat setting behavior. The analysis resulted in an estimate of the energy savings and dollar savings from connected thermostats for each U.S. climate zone.

7D: Are Smart Thermostats Really That Smart?

Moderator: Jennifer Robinson, EPRI

Speaker: Kristin Heinemeier, UC Davis - WCEC

User Response to Smart Thermostats: "That Thing has a Mind of its Own!"

The technology for thermostats has changed significantly in the past decade. Adaptive control algorithms and anticipation strategies have helped to make thermostats a potentially powerful tool for reducing energy used by HVAC systems in both homes and commercial buildings. However, with this increasing technical complexity has come a corresponding complexity in the user interface. The round dial has been replaced with a touch screen and the options for programming are seemingly infinite. Simple schedules have been replaced by complex 7-day schedules. Even the touch screen has been supplanted by web-enabled thermostats that can be set by complicated software programs. The latest trend in thermostats is to learn the occupants' patterns and anticipate what the setpoints should be. These "learning" thermostats have very simple interfaces, but complex and non-transparent algorithms to determine the desired setpoints, derived from user interaction over an initial period. This paper describes a study of advanced thermostats installed in three non-residential locations (a restaurant, golf clubhouse and school). The thermostats were installed by contractors, and occupants received no training in their use, as is typical. A message board was made available to the occupants so they could record their experiences with the thermostat and communicate with the research team and each other. Occupants were periodically instructed to make some sort of a change to the programming, and their interactions with the thermostats were automatically logged. The response of the occupants to the thermostats was universally negative. "That thing has a mind of its own!" and "How can I set it so it's just like a simple thermostat?". Furthermore, energy savings from the "smart" thermostats ranged from minimal to negative. The study found that significant training and support would be needed to enable occupants to utilize advanced thermostats easily and in a manner that optimizes their energy use. The paper discusses the conclusions drawn about these difficulties, the implications for new thermostat design, and the potential for utility-funded thermostat replacement programs.

7E: Results Are In: Savings Are Real

Moderator: Sharyn Barata, Itron

Speaker: Tami Buhr, Opinion Dynamics

Energy Savings and Beyond: Measuring the Success of Marketing, Education, and Outreach Efforts

Most behavioral programs rely on a few different methods to encourage people to save energy including home energy reports, in-home energy displays, contests, and other games. Such programs have attracted a lot of attention as alternatives to existing demand side management (DSM) programs that encourage energy saving actions through customer rebates. Marketing, education and outreach (ME&O) efforts that utilities and program administrators conduct do not receive the same amount of attention as DSM or other behavioral programs yet they undoubtedly impact customer behavior. While rebate and behavioral programs have energy savings as their ultimate success metric, marketing efforts tend to have multiple goals and metrics associated with them. Examples of these metrics include increased consumer knowledge of energy efficiency programs and energy saving actions, marketing campaign and program awareness, and program participation or channeling. As a result, we lack a similar metric for marketing efforts compared to other program efforts, and therefore do not hold these efforts to the same standards of effectiveness. The end result is that the energy efficiency community does not rely on ME&O to change customer behavior like other behavioral programs. In this presentation, we will utilize current work in California and the Northeast to assess several different metrics used to assess marketing effectiveness including awareness, knowledge, program participation and energy savings. This paper will provide examples of different evaluation methods that can be used to assess the effectiveness of marketing programs. With a better understanding of the impact of ME&O efforts, program administrators can include these efforts alongside DSM and other behavioral programs to achieve energy savings.

7E: Results Are In: Savings Are Real

Moderator: Sharyn Barata, Itron

Speaker: Suzanne Shelton, Shelton Group

Because saving money isn't enough, and most Americans don't think energy efficiency is "worth it."

We know everyone wants to save money on their utility bills. The problem is that over half of Americans don't actually believe it's possible – they've tried and seen their utility bills stay the same or go up. Further, most Americans are certain that energy efficient improvements won't improve their home's resale value. The net effect of these pervasive "truths" is that propensity to make EE improvements AND behavior changes have dropped significantly in the last three years. The fundamental challenge with trying to motivate more measure implementation and behavior change based on a financial reasoning approach is two-fold: first of all, it's a rational argument vs. an emotional one, and emotional drivers are far more powerful and motivating. Secondly, it's a promise that can't be delivered on. Our data documents that 53% of Americans would likely use more energy upon installing efficient products. Thus, the most effective approach to engage Americans in wholesale EE adoption is one that appeals to their individual emotional drivers (such as feeling safe, feeling in control, gaining peace of mind, feeling like a good person, or avoiding feeling like a bad parent), AND continues to engage them over time to install more measures and change more behaviors, tapping constantly into those core emotional drivers. At Shelton Group we've been regularly polling Americans in a statistically significant fashion about their attitudes and behaviors related to energy and the environment for a decade. We've been using the insights gained from those studies to help our energy and building product clients more effectively market their products and services. Based on years of polling and years of in-the-field practice, we've also invented a software platform called Do 5 Things, intended to increase EE measure adoption and behavior change via our proprietary consumer segmentation system, and ongoing engagement with emotion-powered messaging. We launched our first pilot of this program with Consumers Energy in Michigan in October 2013, and we're launching a second pilot in May of this year with Alliant Energy in Wisconsin. Suzanne Shelton, CEO of Shelton Group, will share the key insights behind the platform, how it works and what the results and lessons learned have been so far in the hopes that there are insights/learnings the entire audience can use in their marketing practices.

7E: Results Are In: Savings Are Real

Moderator: Sharyn Barata, Itron

Speaker: Anne Dougherty, Illume Advising LLC

Savings at Scale: Effects from the first Statewide Behavioral Program

"Behavioral programs" have typically targeted high usage homeowners, overlooking potential savings associated with a broader, mass-market rollout. Further, interventions have largely been limited to report-only efforts. As these programs expand, it is critical to assess their potential impacts across a broader swath of the population and assess where savings may be "left on the table" in many energy efficiency portfolios. This paper will share the results of the first-ever statewide behavioral program implemented by National Grid in Rhode Island. With a focus on targeting the entire state, National Grid's program treated often overlooked populations such as low-usage customers and new movers, and integrated multiple outreach strategies to garner greater engagement across the state. In this paper, the authors will detail the findings from the statewide Rhode Island program, and will share the impact and process results from the following program efforts: (1) home energy reports (HER), (2) mass market online web portal, (3) rewards, (4) mass media promotional and PR activities, and (5) a programmable communicating thermostat (PCT) pilot. Utilizing a statewide experimental design, the program implemented HERs and then further subdivided HER participants into rewards treatment groups. Our paper will detail the statewide design and discuss how key experimental design decisions affected our ability to detect, or not detect, savings associated with the program. Specifically, we will discuss the following results: • Overall Net Savings: This is the savings value measured for the behavioral program using experimental or quasi-experimental designs. This includes: o Total program savings gained for each treatment group, such as low, medium, and high users as well as new movers and customers treated with multi-fuel messaging. o Incremental rewards savings gained through the rewards component o Savings associated with thermostat efforts where the program introduced programmable thermostats. • Cross-Program Effects or "Channeling" Effects: We also examined the impact of the statewide behavioral program on driving program participation in other National Grid efforts, thus examining portfolio-wide benefits. • Cross-fuel effects: All National Grid customers receive both gas and electric services from National Grid. This offers a rare opportunity to examine how electric benchmarking may impact whole-home energy usage behaviors. For example, we will answer the question: How many therms are saved in the home as a result of electric benchmarking? Drawing on this unique statewide program design, we will be able to dig deeper on the potential of behavioral programs to drive mass-market effects both within their own program and across the portfolio.

7E: Results Are In: Savings Are Real

Moderator: Sharyn Barata, Itron

Speaker: Brian Arthur Smith, Pacific Gas and Electric Company

Business Energy Reports: First Year's Evaluation Results

The first comparative energy usage initiative launched by Pacific Gas and Electric Company (PG&E) targets residential customers and was launched in August 2011. Called Home Energy Reports (HER), this initiative has proven successful in reducing electricity and gas usage. Similar programs are now deployed in utilities throughout the world. Following on the success of the HER Program, PG&E launched a trial of Business Energy Reports (BER) in collaboration with Pulse Energy in October 2013. The BER trial targets a more challenging customer segment: the diverse population of small and medium businesses (SMBs) that have traditionally been underserved by PG&E's energy efficiency programs. The BER trial bears some similarity to HER programs in that it provides mailers featuring peer comparisons on energy use and energy savings suggestions that are tailored to specific business segments. In practice, providing relevant information to SMBs is considerably more challenging than providing such information to residential customers. PG&E's BER trial employed a randomized control trial whereby SMBs were assigned to treatment or control conditions. This session presents the results of an early evaluation of PG&E's BER trial after completing one year in the field. The session also presents details of the experimental design, specifically with attention to key learnings on sampling issues relevant to SMB population including the determination of sample frames, techniques to ensure balance between treatment and control conditions across business segments, and the methodology used to estimate electric and gas savings. Energy savings estimates for both electricity and natural gas are presented.

7F: Innovative Community Policy Case Studies

Moderator: Ines Azevado, Carnegie Mellon University

Speaker: Diane Schrader, The Transfinity Group

Innovative Financing for Commercial Energy-Efficiency Investments: No, It's Not PACE

This presentation describes a case study of an innovative energy-efficiency financing platform successfully piloted with small business owners in California in 2012-13 and now building to a larger scale. The program is implemented by the Transfinity Group, a private investment firm, in collaboration with Lawrence Berkeley Labs, University of Southern California, the Los Angeles Department of Water and Power and Climate Resolve, a non-profit community group. Up-front financing is provided for cool roof upgrades for flat-roofed small commercial buildings and repayment occurs at the time of the sale of the property. The case study will cover the key behavioral aspects of the program (which relies on social norms, peer-to-peer communication, framing and other community based social marketing approaches) as well as the financial mechanisms and documented energy savings. According to 2012 US Census data, 74% of all US commercial property is less than 5000 square feet. This is small business, the driver of the US economy. Though energy use is often the single largest operating expense in small commercial buildings (ENERGY STAR), 95% of small business property owners cannot access third-party financing (Greentech Media) for financing energy upgrades. The Transfinity program addresses the problem of access to capital and uses social media marketing techniques to build participation and commitment. The initial pilot program focused specifically on removing financial barriers and offered a variety of efficiency products. In the pilot, Transfinity funded 57 upgrades, after receiving 460 applicants based on viral marketing alone. The program is now being expanded to encouraging adoption of "spray polyurethane foam" cool roof a technology that can reduce energy consumption by 30-50% (Lawrence Berkeley National Laboratory). The program launched in Los Angeles, CA, with a broader area and additional energy/water technologies being added. Results from the expanded program covering the summer of 2014 will be available at BECC. The presentation will provide behavioral lessons learned relating to each of the groups involved – financial institutions, small business owners, contractors, the utility, policy-makers and community organizations involved in implementation. It will also incorporate results from a "boots on the ground" survey of owner-occupied small businesses conducted by USC. In addition, it will describe research to test whether there is a spillover effect of behaviors into the residential sphere from the small business program. I propose to present Transfinity's work in Los Angeles as part of a real-world case study. Two other abstracts are being submitted to BECC which we hope would create a strong case study panel – one from USC and the other from Climate Resolve.

7F: Innovative Community Policy Case Studies

Moderator: Ines Azevado, Carnegie Mellon University

Speaker: Luciana Lopes Batista Vinagre, Eletrobras

Education for Energetic Efficiency Based on Audiovisual Communication Project Energy that Transforms

The project "Energy that transforms" is an initiative from the Federal Government of Brazil, conducted through a partnership between Roberto Marinho Foundation and Eletrobras, under the National Program of Conservation of Electric Energy (PROCEL). This project is an interdisciplinary pedagogical proposal, which allies communication and education in order to stimulate a new culture for the efficient using of electric energy. This project comprises two series - as one of them being produced for TV, entitled "Life of Republic", and the other one for the radio, called "Hello, João!"- printed material and actions of implementation in public schools. All the materials are gathered in an educative kit available for educators. This TV series, besides being part of the kit, was also shown for Brazilian viewers by an educative TV (Futura Channel). These TV and radio programs, as well as all the printed material, are based on the idea the energetic efficiency depends on both technology and the behavior of people who use electric energy. The material contents cover the cognitive and affective domain and aim to inform about the energetic issue in Brazilian society, sensitize people to reduce the waste, favoring participation and the behavioral changes. The proposal is utilizing these materials as an additional complement to the curriculum, through an interdisciplinary approach of the theme "Energy". The implementation of this project took place in four Brazilian states and included the performance of activities on educators training, monitoring and evaluation. Results of the project reveal a significant increase of the indexes that evaluate the consolidation of concepts and the association of the themes "energy, energetic efficiency and sustainability". The evaluation has also indicated significant improvement concerning to habit changes and commitment with the questions related to the efficient use of energy. It is important to highlight that the investment in public politics related to behavioral change to the energetic efficiency must be seen as a long term action, because sporadic actions do not cause the proper effects on this change. Education, supported by the interaction between pedagogical and psychological models, shows itself as a strategic alternative to the formation of a generation compromised to energetic efficiency culture.

7F: Innovative Community Policy Case Studies

Moderator: Ines Azevado, Carnegie Mellon University

Speaker: Jennie Loft, City of San Jose

San José Bring Your Own Bag Ordinance

San José implemented one of the most comprehensive plastic bag bans in the nation. After a comprehensive stakeholder/community engagement process, San José developed an ordinance that would be a new model for other cities. Two years after the implementation, San José now has results showing a significant reduction of litter. The Bring Your Own Bag Ordinance began on January 1, 2012. It addressed both plastic and paper bags and included a comprehensive list of businesses that would need to comply. The ordinance prohibits single-use carryout plastic bags provided at checkout by all retail businesses located or doing business in the City of San José. This included a list of over 6,250 grocery stores, convenience stores, pharmacies, hardware stores, local retailers, national retailers, and mobile retailers. Stores may sell paper bags made of at least 40 percent post-consumer recycled content for a minimum of 10 cents for each bag. Plastic bags are lightweight and are found in storm drains, creeks and ultimately to sea. The San Francisco Bay Municipal Regional Stormwater Permit requires San José to reduce trash from the storm drain system by 40% in 2014, 70% by 2017, and 100% by 2022. Three of San José's waterways are identified as impaired by trash. San José has a Green Vision goal to divert 100 percent of waste from landfills. Green Vision is a framework connecting economic prosperity with environmental sustainability. In California, 13 billion plastic bags were distributed annually, and only 3% recycled. It's more costly to process and recycle than to dispose of them. They jam recycling processing equipment, costing haulers when they manually dislodge plastic bags. Both paper and plastic bags require consumption of trees, water, energy and fossil fuels to produce. There's also the energy and pollution created from the manufacturing and transportation of bags. San José staff considered options to substantially reduce both plastic and paper single-use bags. Goals of this project included ensuring businesses and the community had an opportunity to provide input into the development of the ordinance, to use the input to guide ordinance development, and to involve stakeholders in ordinance implementation. Public outreach and collaboration with local stakeholders were key to the positive results. In 2011, prior to the ordinance, over 1,300 plastic bags were removed from 10 creek hot spots. In 2013, after clean-ups at 10 creek hot spots, only 190 bags were found. Data from these creek cleanups show a 73 percent decrease in plastic bags found at creek hot spots. One hauler reported a 24% reduction in retail plastic bags coming through their recycling recovery facility. Based on in-store visual observations, 98% of retail stores are complying with the ordinance. They're no longer providing single-use plastic carryout bags for free, and were selling paper bags for a minimum of 10 cents each. The successful implementation of the bag ordinance is a significant credit towards litter reduction goals associated with the City's stormwater permit. Currently, California, Massachusetts and Washington are considering legislation that would ban single-use bags.

7F: Innovative Community Policy Case Studies

Moderator: Ines Azevado, Carnegie Mellon University

Speaker: Yael Parag, School of Sustainability, interdisciplinary center

Integrating Demand Side into Carbon Reduction and Energy Security Policies in the UK via a Negawatt Market

A transition to low-carbon energy systems presents challenges to the existing supply-oriented energy security policies. In future electricity systems consumers' actions, such as demand reduction, demand-side response, and the provision of small-scale electricity generation and storage capacities are likely to be essential for the system to function. However, the lack of a reward system for behaviours and practices that support the functioning of a low-carbon grid impedes the involvement of consumers in the system. Integrating consumers requires a paradigm shift in the way energy policies and electricity markets are structured. Applying a socio-techno-economic perspective for demand-side integration we propose a Negawatt market as a tool for enhancing consumers' contribution to the electricity market in the UK. Instead of the traditional techno-economic approaches, which concentrate on supply and on generation technologies and capacity, we focus on demand and on the services provided by users to the system. In the UK, demand-side policy mechanisms are currently designed to influence investments in energy efficiency technologies. This demand-side approach is claimed to achieve 40% saving of total electricity demand by 2030. However, a few key adjustments to current policy are needed for this to happen, such as the introduction of Electricity Efficiency Feed-in-Tariff (EE FiT). EEFiT would provide a transparent economic incentive for householders and others involved in energy saving schemes. It would not rely on energy companies, which have little incentive to reduce demand, while end-users' roles and benefits would shift from being consumers to active participants in securing energy services via improving energy efficiency. A Negawatt market goes beyond energy efficiency.It allows consumers to choose which energy services they want to reduce, which they want to resume and when. This voluntary behavioral change eliminates risks associated with negatively impacting users' well-being. A well-structured Negawatt market has the potential to save / earn money, reduce electricity consumption while simultaneously acting as an enabling mechanism for creating new markets and niches needed to prevent further technological lock-ins. Through its engagement with communities, local governments, ESCOs, and consumers, a Negawatt market would operate as a platform for meso-level actors (unlike most supply-side policies) by transforming people and organizations from being merely passive electricity consumers to active participants in the power sector. This is particularly important with the electrification of the heating and transportation systems in the UK, which in turn is expected to double electricity demand by 2050. A Negawatt market can open up possibilities and opportunities for actors and ervices that do not rely on the big six energy companies, such as off-grid energy services, decentralized local generation, energy efficiency, Advanced Metering Infrastructure and storage facilities. Integrating a Negawatt market as part of a demand-side approach along with the existing supply-side policies (which include the capacity mechanism, carbon price floor, feed-in-tariff, and emission performance standard), can assist the UK in meeting its energy security and climate change mitigation targets at a lower cost, in the short-term and with the support of the public.