Abrash Walton, Abigail, Antioch University New England

Change Leadership for a Changing Climate: Positive Deviance, Innovation, and Institutional Investing

This presentation deepens understanding of U.S.-based foundation leaders' role in enacting one approach to addressing climate change: institutional fossil fuel divestment. Since 2011, a growing movement has emerged focused on divestment of fossil fuel assets and reinvestment of those resources in climate solution-oriented approaches, including clean, renewable energy. Pledged and/or already-divested global institutional assets total more than $50 billion. Encouraging individuals to engage in pro-environmental behavior (PEB) at an organizational level, where individual behavior is shaped and aggregated by organizational or sectoral policies and practices, is a critical locus for change. The study used a qualitative research design to explore foundation leaders' motivations and actions in pursuing divestment, while simultaneously exercising their fiduciary duty to steward institutional assets. Research questions focused on the divestment behavior change process and the outcomes of divestment on leaders and their organizations. Data analysis was derived from two datasets: 34 foundation divestment commitment statements and semi-structured interviews with 18 foundation leaders. Total combined assets of the population organizations equaled US$3 billion. Findings suggested that leaders engaging in fossil fuel divestment may experience higher levels of satisfaction, pride, happiness, and engagement with their organizational roles. This study extends scholarship on psychology of climate change, PEB, socially responsible investing, and the Transtheoretical Model of Behavior Change (TTM). Implications for theory and practice: (a) builds on Stern's PEB typology to include investing; (b) extends the TTM to include a change leadership dimension; and (c) provides methods and analysis that can inform practitioner-designed behavior change initiatives.

Abreu, Joana, Fraunhofer CSE

Encouraging Sustainable Practices Beyond Here and Now: The Case of Programmable Thermostats for Low-Income Tenants

Research has shown that programmable thermostats can help families save on energy costs while keeping homes at comfortable and healthy temperatures. By setting back the temperature when the homes are not occupied or overnight, the occupants can save and keep homes comfortable. 40% of the thermostats in use in America are programmable. We designed a randomized controlled experiment to evaluate the effect of two behavioral interventions in the willingness to keep using thermostat schedules. The experiment had three experimental groups: G1-Control: no intervention; G2-Ability: custom-program the thermostats according to occupants' schedules and comfort preferences, and leave a sticker to remind the families to go-back to use schedules and keep home comfortable; G3-Motiviation: In addition to G2-Ability, we obtained verbal and signed commitments to keep the schedule during the heating season. We present the final evaluation results of this pilot: we discuss the similarities between groups before the beginning of the experiment; and the statistical impact of the treatments in the temperature of the homes during nighttime and daytime. We found energy savings for both groups G2-Ability (2%) and G3-Motivation (1.5%). Based on these results we suggest that the activity of programming the thermostats according to familial habits and remind occupants to press run to use the schedules should be adopted as a measure that is a part of a portfolio of energy efficiency offers designed to help low income families to adopt new sustainable habits that can help them adapt to scenarios of increasing energy prices and climate change.

Adelstein, Aaron, Master Builders Association

Homeowner Behavior in the First Net Zero Energy Townhomes in the U.S.

zHome was the first net zero energy townhome complex in the United States. The project was launched to spur the market toward deep green housing for the average person. As such, zHome was built to rigorous benchmarks including net zero energy use and a 70% reduction in water use compared to the state average. After the development had been occupied for several years, we deemed it important to check on its outcomes — both quantitative performance measures and qualitative homeowner satisfaction. Too often, projects are lauded as successes upon completion, with no follow-up to see if the home is performing as modeled and if life in it is enjoyable. After studying two years of post-occupancy data, we found that zHome met its goals of net zero energy use and a 70% reduction in water use. Of course, part of this success has to do with the homes' design and part with homeowner behavior – both of which are intertwined. Components of zHome were designed with facilitating homeowner interest and simplifying conservation habits in mind. We interviewed zHome homeowners about why they chose to live in zHome, how satisfied they are, and how their behaviors and habits have changed due to their life in this eco-friendly development. Their responses provide a narrative of happy, willful behavior change due to living in homes designed to encourage these shifts. This session will explore the energy and water saving strategies employed in zHome, performance outcomes, and homeowner satisfaction and behavioral shifts.

Aloise-Young, Pat,

A Formative Evaluation of Behavior Change Elements within a Colorado Weatherization Assistance Program

This project is a formative evaluation of the behavior change elements of an ongoing Weatherization Assistance Program (WAP) offered by the Energy Resource Center (ERC) in Denver, CO. This is a precursor to increasing the behavioral components offered in the program, specifically, customer engagement and promotion of energy saving behavior. The WAP as administered by the ERC saves residents on average 15% of energy consumption (ERC, 2015). However, Gregory (1992) and APPRAISE (2002) show that adding behavioral components to WAPs can increase energy savings to 21-26%. This program evaluation has five phases: 1) review of written materials, 2) interviews with staff, 3) analysis of 2015 energy data, 4) surveys mailed to ERC clients and 5) in-home interviews conducted with ERC clients. Phases 1 and 2 have been completed and preliminary analyses reveal that a) written materials do not consistently target participants' values nor utilize effective behavior change messaging and b) the level of intentional client engagement or education depend on the job function of each staff position, thus are not consistent, and effective energy saving behavior training is not provided. Surveys and interviews (summer 2016) will assess knowledge, perception of control, and energy use behavior. Special attention will applied to behaviors surrounding thermostat, water heater, lighting, and electronics usage to analyze the penetration and probability of these behaviors (CBSM framework). This project will provide a greater understanding of the low-income population of Denver and their unique energy use behaviors to inform recommended behavioral components that match their needs.

Antunes, Carlos, Univ. Coimbra, INESCC

From the Technical to the Humnan Potential: The Development of an Energy Management System

In the transition to a decarbonised economy end-users are increasingly involved in the management of energy resources, namely planning electricity usage according to their needs and the economic incentives provided, generating electricity using renewable sources, and storing or trading electricity generated on-site. However, deciding whether to use, store or sell electricity back to the grid in face of dynamic variables (e.g., tariffs, comfort requirements, weather conditions also with impact on generation availability) is a very challenging decision process for end-users, namely in a residential or small business setting, thus requiring some form of automated support. Therefore, energy management systems (EMS) are required to monitor consumption, generation and storage, and to optimise decisions according to input signals and end-users' needs and preferences. This work outlines the development of an EMS to manage in (near) real time energy usage in the residential and small business sectors based on a multidisciplinary approach integrating expertise from the social sciences with engineering. This integrative approach enables eliciting end-users' preferences, while assessing the implications of daily activities and routines to determine end-users' flexibility in energy usage and the optimal management of multiple energy resources.

Arreola, Georgina, Center for Sustainable Energy

EV Adoption Trends Across the United States

This analysis examines differences in adoption trends for electric vehicles across multiple states in the US using a cross section of multiple surveys of EV rebate program participants. Each program has utilized distinct program administration schemes varying from a direct dealer incentive to putting in place MSRP caps to income based rebate levels yet all are run by the same program administrator. The goal is to examine the evolution of EV adoption and the role played by these incentive programs in each market to elucidate whether or how trends in adoption and market growth as a whole have been affected. We will also examine the presence of spillover effects from one program to another to identify best practices and possible markers for success.

Banwell, Peter, U.S. Environmental Protection Agency

The ENERGY STAR® Retail Products Platform: Transforming the way energy-efficient products and messages are delivered through retail.

The landscape of energy efficiency programs is shifting due to the success of ENERGY STAR-focused programs, the evolution of products, dramatic changes in the way products are used and sold, as well as other factors. EPA has developed a collaborative initiative between ENERGY STAR, energy efficiency program partners, and national retailer partners to establish a new approach to traditional retail-based energy efficiency programs to effectively capture remaining energy savings and continue to advance energy efficiency. The ENERGY STAR Retail Products Platform (ESRPP) is a unique midstream program that removes duplication of effort and redundancy in neighboring service territories, streamlines operations and reduces costs, and allows program sponsors and retailers to focus their limited resources on collaborations that differentiate them locally. And, it offers retailers scale – in the form of significant program budgets through the aggregation of low-per unit incentives and lower administrative costs. This session will review the ENERGY STAR Retail Products Platform including its development, the elements of the 2016 pilot programs, a coordinated EM&V framework, and plans for 2017.

Barnes, Jennifer, DNV GL

How Long does Commercial Strategic Energy Management Stick? A Study of Savings Persistence

Strategic Energy Management (SEM) programs are in gaining popularity as program administrators recognize that organizations can realize significant energy savings through operational improvements. However, persistence of these savings beyond the program intervention period has not been well documented. This paper investigates the persistence of SEM practices and savings in organizations that participated in Energy Trust of Oregon's Commercial SEM program. We also explore the program and organizational elements that led to greater persistence. Energy Trust launched its Commercial SEM offering in 2011, during which participating organizations received coaching and technical services through a year-long series of group workshops and on-site meetings intended to instill the principles of energy management and help identify energy saving opportunities. Participants developed infrastructure to support a culture of continuous energy improvement by securing support from executive leadership, assembling an energy team to discuss and execute energy projects, tracking energy use to monitor changes over time, and engaging employees to change energy use behaviors. Energy savings result from modest investments and improvements in facility operations and maintenance and employee actions. To support the persistence of SEM practices and encourage additional savings, the program began offering SEM continuation, which includes ongoing coaching and services. DNV GL is evaluating Energy Trust's first four Commercial SEM cohorts. Beyond verifying the energy savings claimed by the program, this study includes follow-up interviews and analysis with participants several years after their initial engagement to understand the persistence of both the energy savings achieved and energy management practices put in place.

Barrett / Ashley Ruiz, McKinstry, Holly, Brand Cool

Connecting the Dots for Higher Performing Buildings in Higher Ed

According to the USBC, if all new school construction and renovations went green today, the energy savings would total $20 billion in the next ten years. Although U.S. colleges and universities are spending more than $3.4 billion annually on sustainability, most are focusing on facility upgrades without plans to address building operator and occupant behaviors, minimizing optimal sustainability impacts. To explore why this connection is missing, in 2016 McKinstry and Brand Cool partnered to conduct research with sustainability and facility directors at campuses instituting green initiatives across the country. The findings point to similarities also evidenced in the K-12 and government sectors, where formal structures to foster relationships between facility personnel and occupants are lacking. This session highlights the pitfalls inherent within these settings that inhibit pervasive behavior change. In addition to the obvious—like competing priorities and tight budgets that leave funding for behavior change on the sidelines—more subtle obstacles exist, such as dealing with different orientations to sustainability. Engagement approaches and tactics need to vary widely to address the cultural and social needs of the diverse campus population, from administration, faculty and staff (baby boomers and generation X) to students (millenials and generation Z). Using examples from higher ed, K-12 and government, we'll demonstrate how gaps identified by the research can be addressed to create systematic approaches to building efficiency and occupant engagement, while also proving the business case to ensure behavior change can be recognized as a viable aspect within an institution's fiscal and environmental goals.

Barry, Daniel, ecoAmerica

Let's Talk Climate Change within Your Community: New Research and Effective Tools

Americans are inherently tribal in nature, and look to community leaders, such as pastors, politicians, and others, for cues on what behaviors and attitudes to adopt. To empower community leadership on climate change, and to help leaders build support for climate solutions throughout society, ecoAmerica has created Let's Talk Communities & Climate, a comprehensive climate communications guide for community leaders. This guide includes four parts: 1) the current state of Americans' climate change attitudes and beliefs; 2) tested words, phrases, and messages that build resonance and motivation for climate solutions within communities; 3) talking points for leaders to make climate change and solutions personally relevant for their citizens and community leaders, and; 4) a step by step process for crafting a successful personalized message, including an effective sample message. In this session, ecoAmerica's Research Manager Kirra Krygsman will present ecoAmerica's latest research and guide, highlighting key tools and tips for success. This practical, applicable session provides community leaders with knowledge and resources to enhance the efficacy of their climate communications. Participants will leave the session with a clearer understanding of what makes a message successful, key do's and don'ts in communicating on climate, especially in a local government and community context, and the resources available to help build communication capacity within their organizations.

Beck, Ariane, The University of Texas at Austin

Information Salience and Behavior Change in Solar: Three Experiments

The relatively high technical complexity, rapidly changing marketplace, and abundance and variability of information regarding residential solar PV introduce high non-monetary costs of staying informed. Overall, these factors increase uncertainty, diminish confidence in sources, and introduce misperceptions, which could deter those that would otherwise adopt solar. Our prior randomized control trial (RCT), Energy Games, an interactive trivia-style mobile-device game with content on both solar energy and energy efficiency, showed significant increases in perceived behavioral control and intentions toward solar adoption, indicating potential for gamification to accelerate solar adoption. Energy Games prompted additional questions such as: Are the positive results repeatable in more mature solar markets? Was it the game

or the information, i.e. is a passive information format as effective? Do smaller bits of information over time (as in the game) have greater impact than all content delivered at once? Our new within subjects design of Energy Games in a more mature solar market supports repeatability and provides insights on the effect of market maturity. Concurrently, we ran a passive information RCT using Amazon's Mechanical Turk with control, single exposure (all content at once), and multiple exposure (same content in two portions at equal intervals) groups. A pre-survey was used to capture demographic data and prior attitudes toward solar energy, while a post-survey measured changes in attitudes after the information interventions. Preliminary results indicate that both treatments increase perceptions of content familiarity, but that multiple exposures are more effective. This paper will compare results across all three experiments.

Ben, Hui, University of Cambridge

Household Archetypes and Behavioural Patterns in UK Domestic Energy Use

The domestic building sector accounts for nearly one third of total energy consumption in the UK. Savings from retrofitting this sector would make a significant contribution towards the government sustainability target. However, different comfort practices often lead to a mismatch between actual and estimated energy savings. It is thus not clear whether occupant comfort practices should be considered in choosing retrofit measures. In order to answer this question, this study aims to assess the impact of comfort practices upon the energy saving potential of retrofit measures. This study utilised a mixed methods approach including field studies and simulation modelling to test the hypothesis. It firstly looked into the role of comfort practices using in-depth case studies, including semi-structured interviews, questionnaire surveys, diary records, data logger monitoring, and digital records. This was followed by a statistical investigation of a large sample survey, using SPSS to examine the interconnections between comfort practices and energy-related variables. Simulation test was then performed using IES-VE to predict the energy-saving potential of retrofit measures, under various behavioural scenarios based on comfort practices. The findings reveal that occupant comfort practices had a significant impact on the estimated energy-saving potential of all evaluated retrofit options. The study shows that domestic retrofit based on comfort practices would be more cost-effective than otherwise. The policy implication of this study is that retrofit strategies like better integration of household comfort practices can help in delivering larger energy savings with lower cost while ensuring a sustainable and comfortable indoor environment.

Berk, Honey, CUNY Institute for Urban Systems Building Performance Lab

There's an App for That: Can Mobile Technology Impact Behavior?

In the 2015-2016 school year, the City University of New York's Building Performance Lab (BPL), with a grant from the New York State Energy Research and Development Authority (NYSERDA), is researching the impact on energy-saving behaviors among Division of School Facility (DSF) building operators who use LogCheck, a mobile logbook application, in the NYC public schools they manage. LogCheck is used in over 100 commercial, residential and institutional buildings to improve communication between operations and maintenance staff. LogCheck's creators have anecdotal evidence that operators become more engaged with their facility's energy-consuming equipment due to feedback provided by the application, such as the ability to graph trends and receive alerts. The transparency of the process improves accountability for facility managers/building operators and their supervisors, which in turn positively influences behaviors that can increase efficiency. More than 40 building operators, randomly selected by Research Into Action (RIA), an independent behavior research organization, are participating in the study's treatment group. Treatment subjects received iPads loaded with LogCheck and training about the application. BPL will evaluate changes in eight key behaviors between the treatment and control groups based on pre- and post-study surveys to treatment and control groups, and compare pre- and post-study energy data in participating facilities. BPL will submit a final report to NYSERDA in June 2016; the BECC 2016 presentation will summarize findings and discuss its implications for mobile technology to impact behaviors that make large public or commercial facilities more energy efficient.

Bertoldi, Paolo, European Commission

Analysis of Innovative Information Measures to Promote Behavior Change in EU Member States

Actions to increase public awareness to induce behaviour change constitute an important element of policies and programmes for energy efficiency and energy savings. In particular, the overall goal of these policies and programmes is to achieve a decrease of energy consumption through non-technological measures. Energy behaviour change can be targeted at individuals, at communities and at organisations. In this line, the Energy Efficiency Directive (2012/27/EU) adopted by the EU in 2012 to achieve additional energy savings in the Member States (MSs), includes specific provisions regarding consumer information and behaviour in Articles 12 The MSs are required to implement information, awareness-raising and training measures with the aim at changing habitual energy behaviour or investment behaviour of individuals or organisations. The paper identifies the key measures EU MSs implemented or plan to implement in terms of information campaigns and their effective impacts on energy efficiency behaviour and /or the energy saving they create focusing in particular on the article 12 elements: (III) information provisions, (IV), exemplary projects, (V) workplace activities. MSs' main measures identified from the National Energy efficiency Action Plans includes: • Web sites and portals; • Mass media: Radio, TV newspaper advertisement; printed materials as leaflets; billboards; direct mail and electronic newsletters; • Calculation tools: investments, energy savings, CO2 emission reduction; • Datasets • General

information and events: networks of consultation centres; • Modal shift promotion and eco-driving • Education and awareness: textbooks for schools, annual pupil competitions; • Others: energy savings officers at public organisations; Good practices of communication packages and training programs implemented in different MSs have been also identified. The paper highlights and summarises the most important measures, the "lessons learned" with a special focus on cost- effectiveness.

Beschen, Darrell, US Department of Energy

Chains, Nodes, Nexus(es) & Needs to Tip Energy Behavior Profoundly

Abstract: Chains, Nodes, Nexus(es) & Needs to Tip Energy Behavior Profoundly A Challenge. In behavior analysis we tend to focus on a decision behavior. Not enough. The behavior and consequence is only one point in an important string of precedent behaviors and choices. Those decisions have energy consequences obvious in product consumption, even in final disposition, but not so evident or studied or identified along the entire 'supply chain'. Each decision along the 'supply chain' constrains and influences the next. Where supply chain(s) and infrastructure(s) intersect those decisions are 'multiplexed'. We need to know, describe and animate more of what is knowable: the many orthogonal paths of every intersection, the options, the drivers, the implications, the policy impacts, and critical options in technology, information, policy and incentives. So informed, we could: develop the technology, provide the incentives and inform each choice. We have the means to do this, we need the data, integrated models and will. This is knowable and doable and the big and broad beneficial impacts are manifest. Let's lay it out in an interactive presentation. It don't (sic) need to be perfect!

Bliss, Ryan, Research Into Action

Frog Princes and Free-Ridership: Contractor Influence in Residential Programs

Once upon a time a homeowner saw an advertisement for an energy efficiency (EE) rebate program that promised EE upgrades would lower their energy bills and make their home more comfortable and their utility would pay for part of the cost. Inspired, the homeowner hired a participating contractor to install a program measure, submitted the rebate paperwork, and was magically transformed into a "program participant." Like the Frog Prince, the above is just a fairy tale. Drawing from multiple evaluations of residential EE upgrade rebate programs, this paper explores how most homeowners actually become program participants. Instead of researching EE technologies and rebate programs, participants typically stumble into rebate programs, often upon experiencing a heating or cooling crisis. Homeowners often become participants by luck of the draw: the contractor they called to resolve their need (commonly someone they worked with previously) happened to be a participating contractor. The contractor then educates the homeowner on EE solutions and programs that subsidize the cost, ultimately preventing installation of non-EE measures. However, contactors' integral involvement may have detrimental free-ridership effects: contractor influence is so great that participants often report they would have still implemented the measure in absence of the rebate. This paper will explore this NTG paradox – if a program contractor brings someone into a program (that wouldn't have participated otherwise), and the program influenced the contractor's recommendation, then why are program savings discounted when participants claim they would have done the same thing even without the rebate opportunity?

Block, Ben, Clean Markets

Closing the Values-Action Gap: Motivating Energy Efficient Home Construction

Market research continually shows that consumers have a high concern for the environment, but that concern does not match their purchasing behavior of environmentally beneficial products. So how can marketers of clean energy products close this "Values Action Gap" and motivate consumers to purchase clean energy products and services? The Natural Marketing Institute (NMI) and Clean Markets will deliver a joint presentation on consumer attitudes toward environmentally beneficial products and provide examples of leveraging attitudinal research in the design and implementation of energy-efficiency awareness campaigns. The NMI State of Sustainability in America report is an annual consumer research study devoted to understanding consumer values and behaviors across health, the environment, and corporate social responsibility. The report reveals shifting trends in consumer attitudes toward a wide range of environmentally beneficial products, including high-efficiency equipment and renewable energy systems. The 2016 report — an online survey of more than 4,000 U.S. adults — demonstrates that more consumers are likely to try, purchase, promote and pay extra for environmentally friendly products. Yet cost factors and the fact that consumers are more motivated by self- interest prevent most consumers from investing in energy efficient products and services. Clean Markets is a marketing and outreach firm that designs and executes energy-efficiency marketing campaigns on behalf of utility and government clients. Clean Markets' consumer and business-to-business advertising campaigns have achieved greater market penetration for energy efficiency programs by appealing to the underlying emotions that could result from participation, rather than the program's features and benefits.

Borgeson, Sam, Lawrence Berkeley National Lab

Understanding Variability in Residential Load Profiles using Cluster Analysis

Categorization of electricity load patterns is common for load management and tariff designs. For residential customers, such categorization is usually conducted on aggregated load data, partly due to large variability exhibiting within and across customers. However, in the context of demand response programs (DR), individual load patterns directly relate to each customer's ability to respond to program incentives. The relationship between variability in load patterns and demand response (i.e. reducing or shifting loads) depends on underlying variability drivers, e.g. whether variable loads are caused by flexibility or necessity/unavoidable demand. This paper characterizes variability in load patterns of residential consumers and explores the drivers for these variations. Based on one year of hourly smart meter data from over 100,000 residential customers, we employ a novel clustering technique to derive representative daily load patterns focusing on discretionary consumptions. From the daily load patterns we derive a suite of variability metrics on the timing of and magnitude of consumption. These metrics are then related to household attributes obtained from survey data to uncover the underlying drivers. We find attributes such as children and electric dryer ownership associate with higher variability in both load timing and magnitude, while single families and work-from-home associate with more variable magnitude of loads. Our study therefore links household attributes to different potential DR behaviors (shifting and/or reducing loads) and signifies the need to incorporate energy-behavior patterns derived from these newly available smart meter data to improve program targeting in demand response programs.

Borrelli, Sheri, The United Illuminating Company

Transforming Towns And Cities Into Sustainable Energy Communities

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 a reality. Connecticut's Clean Energy Communities program is gaining tremendous momentum with 154 of the state's 169 municipalities pledging to meet 20% energy reduction levels. Eversource and United Illuminating, as Energy Efficiency Fund administrators, provide our communities the necessary tools in becoming sustainable energy communities. Community tools include: partnering on community engagement, gathering energy usage data, benchmarking buildings utilizing the U.S. EPA's Portfolio Manager Software and creating Municipal Action Plans (MAPs) roadmaps to reduce communities' energy consumption and optimize buildings' performance. Once communities identify their "energy stars" and "energy hogs", they are guided through their MAPs to identify cost-effective, energy strategies 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 go deeper and broader into the programs. Every house, business or municipal building that redeems a rebate or participates in an energy-saving program, they earn their community points. Every 100 points earns a Bright Idea Grant, ranging from $5,000 to $15,000. Grants are used for energy-saving projects within the community. From paying for performance-grade energy audits for municipal buildings, hosting light bulb exchanges or leveraging existing incentives, communities have flexibility in determining the grant expenditures to align with their MAPs. Thereby saving energy and becoming resilient, sustainable energy communities.

Branom-Zwick, Jessica, Cascadia Consulting Group

Lectures or Lawn Coaches? Behavior Beyond End-of-Program Intentions

Snohomish County, the City of Olympia, and more than 15 municipal partners in Washington State conducted two distinct natural yard care behavior change programs for residents in two geographic regions using different delivery strategies to reduce polluted runoff and protect local watersheds. Cascadia Consulting Group designed and conducted an evaluation of the two programs to measure the behavior change outcomes and recommend the most effective strategies to use in the future. Cascadia conducted surveys with both participants and non-participating residents at baseline and three to twelve months after education, statistically analyzed behavior changes, interviewed participants and program staff to identify strengths and opportunities for improvement, and developed recommendations that will guide similar programs in the region. This presentation will cover best practices and lessons learned in conducting comprehensive and multi-jurisdictional behavior change evaluations on a tight timeline that can be readily applied to other sustainability areas. It will also offer insights on navigating stakeholder needs, relying (at your peril) on end-of-workshop questionnaires, designing effective surveys, and creating compelling data visualizations to tell the behavior change story. The evaluation report that forms the basis for this presentation can be found at the following link:
http://www.cascadiaconsulting.com/uploads/pdf/natyardcareeval_finalreport.pdf

Brick, Cameron, Hamilton College

Broadening the Tent of Environmental Attitudes Scales

Measuring individual environmental attitudes is important for predicting individual behavior, but current scales signal social group membership such as political liberalism. These scales of environmental attitudes predict environmental behavior, but only weakly (e.g., Brügger, Kaiser, and Roczen 2011). A second issue with current attitudes scales is that they are proposed to mediate the relationship between underlying individual differences (e.g., personality, values) and behavior, but evidence for attitudes as this mechanism is limited (e.g., Brick and Lewis 2014). The Moral Environmentalism Scale (MES) is a novel measure proposed here and constructed based on Moral Foundations Theory (Graham, Haidt, and Nosek 2009) to ensure that the item language includes liberal and conservative views of morality in regards to the natural environment. We first

ran exploratory factor analysis and found that the MES items load on a single underlying factor. Using Item Response Theory, we find that our items provide variance in terms of difficulty. We then tested convergent validity by correlating the MES with two established scales of attitudes: the New Ecological Paradigm (NEP) and Connectedness to Nature Scale (CNS). Finally, we show that MES outperforms both the NEP and the CNS for predicting a wide range of pro-environmental behaviors.

Brock, Josh, Renovate America

Seizing the Moment: Helping Homeowners Make an Efficient Choice

Every year, one in six homeowners has to replace a system in their home that affects energy or water consumption. Three-quarters of the time, they choose an inefficient product based on price—not factoring in potential savings of a more efficient option. That's a missed opportunity. PACE (Property Assessed Clean Energy) has proven to be an effective method for bringing energy efficiency, renewable energy, and water conservation to more homes through its innovative financing model. Using PACE, Renovate America has created an integrated platform that helps seize the moment opportunity to help homeowners make an efficient choice and local governments reach climate policy objectives. In four years, developing public-private partnerships and a powerful platform of thousands of contractors, Renovate America has financed $1.3 billion of projects in more than 55,000 homes, saving 8.9 billion kWh of energy and 3.6 billion gallons of water, and creating more than 11,000 clean energy jobs (as of April 5, 2016). The company has securitized more than a $1 billion in Property Assessed Clean Energy bonds, bringing private capital to meet public policy objectives and creating a new asset class. This session will provide a case study on the Renovate America platform and discuss how PACE, as a macro-scale behavior change program, is helping to change the behaviors of homeowners and contractors to improve the housing stock, increase the value of homes, and create environmental and economic benefits for their communities.

Brown, Kate, University of Illinois Urbana-Champaign

Illinois Smart Meter Awareness, Research and Technology (iSMART) Pilot Project: Transforming Public Housing Authorities into Smart Energy Consumers

Illinois has 99 federally-funded public housing authorities (PHAs) operating over 51,000 affordable housing units statewide for low- and extremely low-income households. In light of recent federal budget constraints, it is imperative for the PHAs to reduce their utility expenditures by investing in energy and water efficient practices. Deployment of efficiency and its associated technologies remains a challenge for this demographic due to lack of knowledge resources, split incentives where residents may receive free utilities or a monthly federally subsidized stipend, and social norms within the housing authority. It is believed that through knowledge and awareness, the low-income demographic can become better informed energy consumers, empowering them to lower their energy consumption and utility costs. The iSMART Pilot Project is a tailored educational intervention and feedback research project for low-income and senior consumers living in public housing throughout Illinois. Five groups of residents and housing authority staff have participated in increasing levels of energy efficiency and smart grid education, coupled with real-time feedback provided by the installation of smart meters and associated smart technology. Pre- and post-intervention behavioral surveys and utility analysis are used to examine the effectiveness of each education and smart device package on energy consumption behavior. Energy use surveys measure the change in attitudes, beliefs and perceived behaviors of residents and staff. Utility consumption information measures whether changes in attitudes translate into measurable changes in consumption of water, natural gas, and electricity. Smart device ease of use and additional demographic energy needs are also identified.

Bull, Richard, De Montfort University

Are Students the Future of Energy Efficiency? Findings from an EU-Wide Energy Saving Project

The role of energy dashboards as mere feedback devices has rightly been criticised in recent years, for their 'information deficit' model. Similarly, the success of University energy saving competitions using energy dashboards has been well-documented demonstrating varying levels of success. This paper presents findings from an EU funded international competition which discusses insights on a scale previously unseen. SAVES is an inter-dormitory energy-saving competition that is being run in five countries and has reached over 50,000 students over the last two years specifically, 484 dormitories at 17 Universities. Building on the successful UK 'Student Switch Off; competition run by the National Union of Students, SAVES provides engagement with students, enabling, empowering and motivating them to save energy – focusing specifically on the last stage of the 'Awareness, Interest, Desire, Action' framework. Smart meter data is used to run real-time energy challenges, inform students how much energy they are using, and encourage peer to peer learning and international cooperation through a virtual twinning scheme. This paper presents findings on the effectiveness of Student Switch Off competition, as it has been implemented in Europe. A mixed methods approach (pre/post intervention surveys, focus groups and analysis of the energy metering data) was taken to evaluate the level of energy savings and quantifiable behaviour change delivered in students across participating dormitories and countries. Reflections and recommendations are offered towards the role of dashboards and student led competitions.

Burger, Alissa, Center for Sustainable Energy

Scaling Energy Benchmarking Policies

The recent passage of California AB 802 is a national game changer with regard to benchmarking, collection, and use of building performance data to improve energy efficiency. Assembly Bill 802 (Williams), signed into law in October 2015, requires the Energy Commission to create a benchmarking program through which building owners of commercial and multifamily buildings above 50,000 square feet will publicly report annualized benchmarking metrics, "which enables understanding of a building's energy usage for improved building management and investment decisions." As California moves forward with the nation's first time-certain statewide benchmarking program, we are working through new challenges such as reaching large, distributed groups of stakeholders, supporting the smallest and largest utilities in providing whole-building energy use data to customers, and ensuring that building owners and managers understand the new requirements and have the data and training necessary to comply. This session will break down what it takes to launch a large-scale benchmarking program from data access through to transparency, examine the policy and infrastructure barriers that need to be addressed, discuss proven strategies for outreach and training, and share lessons learned from California's first year in developing a statewide policy and program. Finally, we will look into the future and discuss how California hopes to use benchmarking to accelerate Zero Net Energy and meet its goals to double energy efficiency in buildings by 2030.

Burwick, Carol, Duke Energy

The Imporance of Customer Engagement for Wi-Fi Connected Home Products

Duke Energy's HoM Energy Manager program combines both energy efficiency and demand response in a direct install Wi-Fi connected thermostat program. In addition to the thermostat, customers receive an interactive web-based application to set and control the temperature of their home. The application also engages customers with energy savings tips and a comparison of their energy usage with similar homes. Keeping customers engaged serves two purposes: keeping customers on track to save energy and maintaining an open line of communication with customers whose thermostat may lose connectivity to Wi-Fi in the future. The demand response function of the program relies on the connectivity of the thermostat. Assisting customers with Wi-Fi connectivity is a costly component of the program.

Cathcart, Jenni, Vermont Energy Investment Corporation

Design Thinking: An Innovative Approach for Utilities to Unlock Customer Value

Utilities face pressure to achieve deeper energy savings – even as rapid shifts occur in regulatory models and technologies. Human-Centered Design forces us, as utility professionals, to turn the mirror around and place the customers we serve at the center of the program design process. By better understanding what our customers truly value, we can derive innovative new solutions to difficult problems. This presentation demonstrates how Efficiency Vermont is utilizing Human-Centered design, a proven approach to problem-solving, to reimagine its residential and commercial lighting design programs.

Chasan, Cavan, KSV

How to Stay Relevant to Your Customer: Personalization vs. Segmentation

KSV's 2016 market research (surveying 1,500 homeowners nationwide + over 200 qualitative interviews with customers) tells us that the #1 thing customers want out of utility communications is relevancy and personalization. In this marketing session, we'll evaluate how customers feel about communications they currently receive from their utility. (A preview: http://bit.ly/1SprfMA) We'll analyze two important methods: Segmentation vs. Personalization. Segmentation has always been smart marketing. It leverages common characteristics, needs, wants, interests across audiences. But how meaningful are 3, 4 or 5 segments? How alike are customers when you've got millions in each group? Is segmentation an outdated approach to 21st century marketing? Personalization allows marketers to leverage prime marketing opportunities with personalized and timely customer interactions across channels. It thrives on real-time data inputs integrated with brand-owned customer data and an always-on approach to marketing. Segmentation brings value and understanding, but it's not the answer anymore. True success will come from mapping your brand to each customer's personal journey. It's a model truly focused on providing the most personalized experience for customers, whether you're targeting them or if they're engaging you. Less work for the customer. Higher return for you. In this session, Cavan Chasan, executive connections director at KSV, will share customer insights from the research and an action plan of how to personalize marketing communications, driving stronger leads and higher conversions. This session will be especially interesting to utility marketers. Founded in 1977, KSV is a marketing firm focused exclusively in energy and sustainability.

Chase, Karen, Energy Trust of Oregon

Collaborating with Progressive Initiatives in Rural Oregon Communities

Many Oregon rural communities continue to lag well behind the metropolitan areas in economic recovery, with median household incomes well below that of the state, and higher poverty rates, often topping 20 percent. These rural communities are regularly short on the resources and capacity needed to start and maintain community initiatives. At the same time, some small, rural Oregon towns and counties have residents and leaders who are motivated to prioritize smart energy changes that benefit their community. Energy Trust of Oregon employs two rural outreach managers, with deep knowledge of their regions, people and communities, and these staff worked with Sustainable Northwest, a Portland-based nonprofit, to plan community energy workshops in multiple rural communities over the past two years. Concurrently, Energy Trust launched an internal Diversity Initiative that, in part, seeks to understand and engage customers that haven't yet participated in programs or services, like customers in Oregon's rural communities. Energy Trust staff have seen the benefits of placing outreach managers within rural communities where service delivery is more complex and residents characteristics differ from metropolitan areas. This fall, the rural energy workshop communities and Energy Trust's outreach managers will meet in a central location with other communities from around the state to share lessons learned and collective benefits to ongoing collaboration as they progress toward cleaner energy communities.

Cibor, Cathy, Alta Planning + Design

Measuring Transportation Behavior Change: Past, Present, and Future

Since the 1970s, transportation planners have attempted to influence travel behavior and encourage sustainable transportation through social marketing programs. But how do we know these programs are effecting change? And how do we measure that change for a habit that is so complex—one that requires individuals to make multiple decisions each day (work, school, store, etc.) for which there are multiple options (carpool, bicycling, staying home, etc.)? While many of the original outreach and intervention strategies are still used in transportation behavior change programs today, how we measure effectiveness has evolved over time. Large budgets and academic rigor have given way to the need for efficiency and rapid results. Having employed detailed phone surveys, mail-based travel diaries, door-to-door interviews, and more—and having explored changes in individuals' awareness, intent, confidence, and one-time, periodic, and daily behavior—program practitioners have tested myriad approaches to quantifying this complex change in behavior. Offering tools and lessons learned that are applicable to the entire behavior change field, this session will cover evaluation trends, innovations, and best practices from the transportation field over time.

Coleman, Philip, Lawrence Berkeley National Lab

The U.S. on 10-15 kWh/day

How much energy savings are possible from behavior change alone, absent significant retrofit investments? A testing of this question motivated this residential case study, with over a decade's worth of data. The test residence was the lead author's roughly 2,500 sf vintage 1980 house in southeastern Pennsylvania, which doubles as his office. During periods of single occupancy, energy usage averaged about 8 kWh and 2 ccf of gas per day, saving roughly $2,000 per year relative to typical residences of similar type and size. With fuller occupancy, the figures were 14 kWh and 2 ccf. This was achieved with old, low-efficiency HVAC equipment (12 SEER central air conditioner and 78% AFUE furnace) and minimal to non-existent comfort sacrifices. How could consumption be this low? Behavior change was the key driver – specifically, aggressive use of the set-back thermostat, very conscientious deployment of windows, shades, a whole-house fan, etc., coupled with conventional low-cost energy conservation measures, such as CFL and LED lighting. Is this model widely replicable? It may be, but it would require training of household members and may not be readily amenable to third-party profiteering. Could utility house call programs integrate behavioral training for residents, using tested behavioral change theories as part of conventional energy audits? In the age of climate change, deep savings are being sought from existing homes, but it may not be realistic to achieve them cost-effectively without considerable resident cooperation.

Cooremans, Catherine, University of Neuchâtel

Energy-Efficiency Investment: Why Do Firms Apply Such Restrictive Financial Methods and Selection Criteria?

The payback time method most often seems to be the only financial method used by manufacturing and commercial firms to estimate the attractiveness of energy-efficiency investments, with a very short payback threshold. On the contrary, in general investment decision-making, three evaluation methods (i.e. NPV, IRR, and pay-back time) are commonly combined and applied to investment projects. This shows that a different—and apparently unfavorable—treatment (in terms of financial methods and selection criteria) is applied to energy-efficiency investments compared to other investment categories. This phenomenon, which could explain why investments in energy efficiency often remain undecided upon, has been identified by energy-efficiency research but no satisfactory explanation has been provided until now. Within this context, one goal of the research project, "Management as a Key Driver of Energy Performance" (M_Key), is to test the hypothesis that the (perceived) strategic character of an investment—defined as its positive contribution to a firm's competitive advantage—influences the type of financial method and selection criteria applied: the less strategic the investment, the more restrictive the financial criteria, and the fewer positive decisions made. M_Key (2015-2017) is supported by the Swiss National Science Foundation (SNSF) and is part of the National Research Programme, "Managing Energy Consumption" (NRP 71 - www.nrp71.ch). M_Key targets large-scale energy consumer companies in Switzerland in

the industrial and services sectors (an important target group since it accounts for almost 35% of the total Swiss electricity consumption). Our research will shed light on the main determinants and practices regarding energy-efficiency investment in these companies, across three empirical levels of investigation: first, survey (1,300 questionnaires were sent out in March 2016), then interviews (which will be conducted in September 2016) and finally, in-depth case studies. Our presentation will describe the preliminary findings of the M_Key survey and interviews regarding financial practices of Swiss large-scale energy consumers.

Cordero, Eugene, San Jose State University

Estimating the Impact of Exceptional Climate Change Education on Individual Lifetime Carbon Emissions

Strategies to mitigate climate change often center on clean technologies such as electric vehicles and solar panels, while the mitigation potential of a quality educational experience is rarely discussed. In this project, we investigate the role of education on individual carbon emissions using case studies from an intensive one-year university general education course focused on climate science and solutions. The course, which has been highly rated by more than 500 students, serves as a model for a quality educational experience that can influence future decisions and behaviors. We survey students who have completed this course at least five years ago to determine their carbon emissions trajectories since taking the class, and we compare this to a control group of former university students with the same graduating years as the course participants. Based on an analysis of the survey results, students who took the climate change class reduced their carbon emissions by over 5 tons/yr as a result of their food, transportation and lifestyle choices. Of the students that reported to have personally experienced the effects of climate change, students from the treatment group reduced carbon emissions by 32% more than the control group. Further analysis of these results and comparisons between education and other mitigations measures will be also be presented. By quantifying the potential role of education on behavioral changes and on lifetime carbon emissions, more informed decisions can be made about investment into education as a climate mitigation strategy.

Daken, Abigail, United States Environmental Protection Agency

Connected Thermostats: The ENERGY STAR Approach to Demonstrating Savings

Past efforts to recognize programmable thermostats as devices that save energy were limited by the unpredictability of how they are used in the field: the presence in the home of a device capable of helping residents save energy was not well correlated with actual energy savings. Now, connected thermostats (CTs) that send data over WiFi to thermostat service providers (e.g. Nest, Ecobee, EcoFactor, etc.) manage HVAC systems in over four million homes. The data from these thermostats can provide visibility into how thermostats are actually being used by residents. EPA has developed an ENERGY STAR specification to recognize CTs that save energy as demonstrated by aggregated information about how the products (hardware plus service) are actually used in the field. There are an increasing number of choices for connected thermostats, and while thermostat vendors claim savings of up to 20%, there has been no accepted procedure to evaluate the effectiveness of these strategies. Until now, consumers (and utilities) have had no way to identify CT products that save energy. Demonstrating savings through field data automatically captures the interaction between the product and the behavior of residents using it. Additionally, with CT technology developing rapidly, and devices that are updated after installation in ways that change their behavioral effects, traditional methods relying on particular features as indicative of energy savings will be difficult to apply. Periodic resubmittal of data aggregated from current users ensures deployed products remain helpful in saving energy.

Dave, Saraansh, Toshiba Research Europe Ltd

Factors Relating to Energy Saving in Households: Evaluating Behavioral and Demographic Variables in a Smart Home Project

This paper presents results from a smart home project trial where the intention to save energy as predicted by models based on the Theory of Planned Behaviour (TPB) was compared to actual energy saving behaviours. One hundred households were involved in the project which aimed to use information and communication technologies to reduce energy consumption within social housing in the U.K. As part of the trial an initial survey was conducted to gather demographic data and behavioural information. The study found that high saving households significantly different self-reported subjective norm measures than low saving households. In addition, households that have a high usage of in-home energy feedback display devices were found to have significantly different perceived behavioural control and intention than low and medium users of the displays. We also found that households' intention to reduce energy was generally stable between the start of the project and 6 months into the project indicating that inherent beliefs were unchanged as a result of energy awareness and engagement. This study has addressed a key research area of comparing self-reported intentions to save energy with objective energy saving behaviours.

DeMates, Laurèn, Lawrence Berkeley National Lab

Trash Talk and Action: Improving Waste Diversion through Organizational Change

Organizations that reduce the amount of waste they send to the landfill can save money on disposal fees, reduce overall environmental impact, and strengthen reputation. It is therefore no surprise that waste diversion goals are a common part of organizational sustainability strategies. However, guidance on how to design successful initiatives as well as the resources to implement them and collect data is limited. For these reasons, efforts to divert waste from the landfill often stop at the deployment of recycling bins. We discuss our implementation of a waste diversion initiative in a medium-sized office building that already had color-coded communal waste stations including compost and recycling but was not meeting facility-wide diversion goals. Our initiative applied low-cost strategies based in behavioral science to improve waste sorting and increase diversion. We discuss the suite of strategies we used to engage with building occupants to improve their waste sorting and how we overcame time and resource limitations to collect baseline data and measure our ongoing process throughout and after program activities. We present the results of our efforts and assess which strategies were more or less successful and how the organizational context can continue to be improved to support waste diversion. We suggest that these results can be leveraged at a larger scale and be used to tackle other environmental issues like energy use in commercial buildings, which may require an alternative set of activities but is similarly driven by a combination of organizational and individual behavior.

Dethman, Linda, Research Into Action

Using Embedded Experiments to Guide Improvements for Behavior Change Programs: A Powerful New Tool

While experiments have emerged as a potent and cutting edge tool for designing and evaluating new energy efficiency behavior change programs, recent research shows experiments have equal power to guide refinements for existing programs. Our talk will first explore the challenges, results, and insights from random control trials (RCT) we embedded in two large ongoing behavior change efforts: the Northwest Energy Efficiency Alliance's (NEEA) TV Initiative and PG&E's Step Up and Power Down (SUPD) campaign targeted to businesses in two large California cities. Each RCT tested specific behavioral interventions intended to enhance program participation. Our talk will conclude with best practices for using RCTs within existing programs – from simple A/B testing of marketing messages to more complex experiments, such as engaging multiple floors to test interventions within a commercial building. For NEEA's TV Initiative, our previous evaluation indicated that both training and TV video walls increased sales of targeted TVs, but the evidence was not conclusive. We designed a RCT not only to test the impact of the TV wall and the training, but also the combined effect of both interventions. The experiment confirmed that both the training and video wall boosted sales of efficient TVs. For SUPD, we tested whether using the behavioral mechanisms of reciprocity and regular feedback delivered through Business Energy Reports (BERs) would increase engagement of hard-to-reach small and medium sized businesses. We found that while previous evaluation efforts showed BERs produced negligible energy savings, they can be repurposed as successful engagement tools.

Divine, Laura, The Energy Coalition

Behavior Change Begins with Education

Children uniquely experience the diversity and wonder of our natural world. Introducing environmental ethics early and consistently pairs innate curiosity with relevant actions, preparing our youth for an imminently changing climate. The combined impacts of positive behaviors prove to be an innovative and model approach to combating climate change. PEAK Student Energy Actions, a K-8 environmental education program of The Energy Coalition (TEC), is channeling these behaviors through action-based, comprehensive programming. Hands-on, standards-based curriculum engages students while developing their interest in climate-focused careers. TEC is the sole provider of K-8 Workforce, Education & Training programming in California and has gained tremendous support from educators, County Offices of Education, utilities and industry partners all working together to meet California's multifaceted climate goals. Despite widespread support, the question of whether or not TEC's model has directly resulted in positive climate behaviors has been left unanswered- until now. Following the 2014-15 academic year, TEC collected 15,885 pre/post-tests from PEAK schools statewide. Through independent analysis completed by Together Brave, a statistical evaluation firm specializing in behavior change, remarkable data regarding student knowledge gains and behavior change emerged. Three out of four students reported saving resources as a result of PEAK and the vast majority reported specifically changing their water (75%) and energy (69%) behaviors as a result of participating in the program. Given the high level of knowledge gains and pro-environmental behavior change reported, PEAK can serve as a model for climate programming to a broad and diverse audience.

Dombrovski, Kelsea, University of California, Davis

Exploring New Dimensions of Eco-Feedback: A Tangible, Community-level Energy Display for a ZNE Building

West Village (WV) is a mixed use zero net energy (ZNE) development on the campus of University of California, Davis. Four years after initial occupancy, WV has yet to achieve ZNE. Behavioral programs to reduce electricity consumption among residential occupants have met with some success, but no attention has been given to behavior in the commercial spaces, which, ironically, are largely composed of offices for energy researchers. This paper describes an office energy feedback project at the Plug-in Hybrid & Electric Vehicle (PH&EV) Research Center at WV. The design of the feedback was informed by a survey and focus group of office occupants. The system consisted of a flag ceremony conducted three times per day, featuring a red or green flag raised outside the office to reflect recent consumption in relation to a ZNE performance goal modeled for the office. The effectiveness of the feedback was evaluated by a follow-up survey and focus group, as well as quantitative analyses of energy consumption before, during, and after the feedback intervention. Statistically significant reduction in average hourly energy consumption was observed during the feedback intervention. The difference did not carry over to a two-week post-feedback period despite substantial reductions in closed hour consumption due to one employee shutting down six servers toward the end of the feedback period. Occupants reported a strong affinity for the novel feedback system. Findings revealed interesting implications for the design of energy feedback in the contexts of offices and buildings with renewable on-site energy generation.

Donnelly, Kat, Empower Efficiency

Behavior Audits and Employee Engagement Campaigns: Finding Gaps in Employee Behavior and Developing Solutions to Motivate Substantial Energy Savings

Within Pacific Gas and Electric Company's (PG&E's) Step Up and Power Down – Commercial (SUPD-C) campaign, Empower Efficiency has implemented a "behavior audit" process and employee engagement campaigns, both designed using behavioral science to achieve commercial building energy efficiency. The behavior audit goals are to assess behavior-based opportunities for energy reduction in large commercial buildings, recommend an implementation plan for achieving those reductions, and provide handholding to facilitate uptake of employee engagement campaigns and existing PG&E efficiency programs. The behavior audit process: (1) applies social science approaches, such as interviews and structured observation, (2) collects information about current energy practices, (3) communicates opportunities for decreasing energy consumption through employee behavior change and reducing barriers to change; (4) helps companies establish savings plans to identify approaches, goals, and completion timelines; and (5) provides post-audit support to ensure uptake of energy efficient actions. Many recommendations are actions that employees can complete, and are supplemented by the employee engagement campaigns, such as Adopt a Light, Tag, You're It, Vampire Slayer, etc. To date, the completed behavior audits recommendations capture low-hanging fruit to reduce energy use by 1 to 10%, combined to lower annual energy use by over 4,100 MWh. The most common recommendations are to increase HVAC setpoints, reduce unnecessary lighting, and power down workstations, often achieved through employee engagement campaign implementation. By September 2016, we should complete over 40 behavior audits and see uptake of over 50 employee engagement campaigns. We will share the techniques and results at BECC.

Drake, Trevor, Great Plains Institute/Clean Energy Resource Teams

Going Farther Together: How 31 Local Government Entities Collaborated to Procure Solar Garden Subscriptions at Low Cost

Community Solar Gardens are gaining increasing interest from electric utility customers across the nation. Unlike individual solar PV systems, solar gardens require the engagement of multiple customers, creating an opportunity for facilitating behavior change beyond the individual level. At the same time, local governments are increasingly being seen as crucial actors for both energy policy and implementation. While collaborative solar purchasing has been documented as an effective way for local governments to procure individually-owned solar PV systems at reduced costs, there is little evidence to prove its applicability to solar garden subscriptions. The Governmental Solar Garden Subscriber Collaborative, a partnership effort of several public and private entities, was the first attempt to apply collaborative procurement to solar garden subscriptions that would offset electricity usage in public buildings. This project organized 31 local governments in Minnesota under a single procurement process that sought 180 MW of solar garden subscriptions – roughly equivalent to a six-fold increase of solar power installed across Minnesota. This presentation will discuss the following: 1) background on Xcel Energy's solar garden program in Minnesota; 2) the process and model used for local government collaboration; 3) project results; 4) lessons learned based on feedback from project organizers and participants; 5) recommendations for future similar efforts.

Dua, Rubal, KAPSARC

Alternative Fuel Vehicles: Who Buys, Who Might Buy, and What Can Induce Them to Buy?

The U.S. federal Corporate Average Fuel Economy (CAFE) program and the multi-state Zero Emission Vehicle (ZEV) program have been set up with the intent to enable the U.S. to achieve energy security and reduce greenhouse gas emissions. Both programs aim to achieve their goals by guiding automotive manufacturers to produce and sell energy efficient and low emission vehicles. However, the success of both programs ultimately depends upon consumer adoption of these vehicles. Current research on estimating adoption of fuel-efficient vehicles using revealed consumer perspective is quite limited. In

this presentation, an organic demand estimate for alternative fuel vehicles (hybrids, plug-in hybrids, battery electric vehicles) assessed through quantitative consumer perspective analysis will be shared. Actionable insights for public and private sector entities on what can help in achieving the estimated market share will also be presented. The presentation will also shed light on whether the different alternative fuel vehicles will cannibalize each other's sales or whether they can all grow concurrently. The analysis is based on last 10 years of nationally representative revealed preference survey data of new car buyers in the U.S., with annual number of respondents ranging from 29,000 in 2005 to 106,000 in 2015. The findings are based on a novel data mining approach, ex-post counterfactual inference, which can identify next set of potential adopters using revealed preference survey data. This is the first time such a method has been used in any field and has applications in other consumer-centric energy challenges such as adoption of residential solar, energy-efficient appliances, smart meters, to name a few.

Duer, Anthony, Applied Energy Group

A Look Inside Those Average HER Savings

Opower's Home Energy Reports (HER) program has gone viral across utilities in the US, as the behavioral pilot program darling. Indeed, each round of evaluations seems to lend further support that the electricity savings from HER programs is in the 1-3% range. These pilots, to date, have been implemented using a randomized control trial (RCT) experimental design. This means that some customers cannot receive the reports, as they must serve as the control group. As some utilities are wanting to move the program to full-scale implementation and/or reduce the cost of evaluation that uses customer-level data, there's mounting pressure to settle on a negotiated per-participant savings estimate and to apply it in subsequent program years. The problem is: most of the pilots have included customer groups that do not evenly represent a utility's residential customer base. Most commonly, the participant group over-represents highest electricity usage customers and/or customers in more extreme weather locations in the service territory. So what's behind the average savings estimates we've been seeing? To answer this question and help address this "ready for deemed" question, we are conducting a refinement of the average savings evaluation we just completed (October 2015) of the 2014 HER program. In this follow-on study, we are estimating the savings achieved by different subgroups of participants. Questions we are addressing include—Do lower usage customers save the same level or % of electricity as higher usage customers? If differently, is there a pattern across usage groups? Do customers on different rate schedules save similarly or differently? Resources permitting, we will look at how the savings of specific participant subgroups might differ, not just from one another but also across different program years. This will allow us to test whether subgroup participant savings show the same kind of stability and patterns we have seen in the program-wide averages. Answers to each of these questions will provide insight and assist both utilities and regulators

Dwelley, Amanda, ILLUME Advising

Mapping the Customer Journey: Pathways to Satisfaction and Deeper Savings

Public utilities are in the midst of re-tooling their energy efficiency programs to prioritize customer satisfaction as a way to drive energy efficiency program participation, and in turn, meet energy savings and climate goals. Consumers Energy committed to customer satisfaction 5+ years ago, and in 2015, launched a "customer journey mapping" initiative to visualize and improve the end-to-end customer experience. Program staff, field staff, web designers and call center staff will use the maps to guide customers to more, and deeper, savings. The results of this effort are three-fold: (1) customer experience maps for each residential program showing the ideal end-to-end experience, including touchpoints for engaging customers, and opportunities to improve the experience, (2) a portfolio-level map showing how customers can navigate and move between programs based on their needs and interests, and (3) action plans showing the changes needed to achieve the "future state" experience. In this presentation we will share the research process, example maps, and customer insights that may be applicable to other programs. The process we used to develop the maps draws heavily on the consumer products and technology industries, and represents a unique approach to thinking about the customer experience in the utility space. We also leveraged a wealth of existing insights that Consumers Energy already had (e.g., ongoing satisfaction surveys), and conducted primary research expressly for this effort. The process of developing the "future state" experience was highly collaborative, including a sequence of remote and on-site workshops to brainstorm and refine each program plan.

Edwards, Carol, Southern California Edison

GIGO: What Are We Putting into Our Energy Efficiency Program Evaluation Research?

This presentation draws on the concept of "Garbage in-Garbage out" to highlight the importance of attending to quality data for sound program evaluation results and conclusions. While the concept of "Garbage in - Garbage out" dates back to the 1800's, it became a more widely known general principle in the information sciences in the 1960's, when it became abundantly clear that quality of the output is dependent on the quality of the input. Program evaluations rely on data gathered via a variety of methods and sources. Whether due to limited budgets, time, analytical decisions to remove/modify data, or lack of attention to data collection sources or instruments, the quality and nature of the data are the foundation of the research, and ultimately the source of the analyses and subsequent interpretations and conclusions. As we continue to make inroads into evaluations of energy efficiency programs through the use of "big" data and

potentially more sophisticated analyses we cannot lose sight of fundamental methodological principles that should drive both the nature and type of data collected in our evaluations. Using examples from recent evaluations of energy efficiency programs, this presentation discusses the importance of thoughtful examinations of reliability and validity in the context of mitigating garbage going into our evaluations. Given the money spent on the evaluations, not to mention perhaps the more significant financial ramifications our evaluations have with respect to improving programs or informing policy decisions we cannot short-change these critical components of our work.

Ehret, Phillip, University of California, Santa Barbara

Psychological Barriers to Bipartisan Public Support for Carbon Pricing Policy

Policy designed to reduce carbon dioxide emissions by increasing the price of emissions is critical to address climate change. However, progress toward carbon pricing policies has stalled in the United States largely because of political opposition. Conventional wisdom is that Democrats and Republicans are divided in support for carbon pricing simply because Democrats believe in anthropogenic climate change and Republicans do not. Yet, several recent polls and the present experiment indicate that most Democrats and most Republicans believe in climate change. We examined two additional psychological barriers to bipartisan support for carbon pricing. One is that partisans evaluate carbon pricing policy proposals according to whether Democratic or Republican politicians support the policy, independent of policy content. Respondents from a national panel (N = 1,056) evaluated cap-and-trade and revenue-neutral carbon tax policies that were randomly attributed to Democratic or Republican politicians. Regardless of the policy viewed, Democrats supported the policies more when they were backed by Democratic rather than Republican politicians, Republicans supported the policies more when they were backed by Republican rather than Democratic politicians. Furthermore, respondents placed party over policy even while believing that "good citizens" should avoid evaluating policies based on partisan considerations. The second additional psychological barrier is that people exaggerate how much other people place party over policy, as when people overestimate Republican opposition to Democratic policies. Partisan opposition to carbon pricing not only reflects personal belief in climate change, but also the psychological barriers that partisanship foments.

Ehrhardt-Martinez, Karen, Navigant

Meta-review of Behavior-based Energy Savings Potential Models and Estimates for Commercial Buildings

What is the energy savings potential from tenant and operator behaviors in commercial buildings? In the United States commercial buildings account for 19 percent of national energy consumption and represent the area with the highest rate of growth. Similarly in the E.U., commercial buildings have been identified as the most promising target for energy use reduction. Nevertheless, typical energy potential studies have historically relied on energy policy tools that focus predominantly (if not exclusively) on technological approaches to improving energy efficiency while largely overlooking the potential impact of the actions of building operators or occupants. Given the long-standing recognition that human actions are major determinants of energy use and often serve to hinder the optimal operation of commercial buildings, the potential benefits of addressing the human dimensions of energy consumption seem increasingly obvious. Nevertheless, the large scale implementation of behavioral approaches is likely to hinge on our ability to quantify the scale of potential energy savings and identify the characteristics of savings opportunities. This presentation will compare and contrast the methodologies and findings of four of the most promising studies of behavior-based savings opportunities in the commercial buildings sector, reflect on their strengths and weaknesses, and discuss key insights. This meta-review suggests that the gross energy savings potential of behavioral approaches is on the order of 21% for office buildings and 12-18% looking across a range of commercial building types. The short- to medium-term achievable savings potential from behavioral approaches is estimated at 7-11% of commercial building energy consumption.

Farah, Humera, Department of Earth and Environmental Sciences, Bahria University, Islamabad

The Efficacy of UNDP-GEF's BRESL Program on Energy Efficient Fans Market: A Behavioral Analysis

Barrier Removal to cost-effective development and Implementation of Energy efficiency Standards and Labeling (BRESL) is a development project jointly pursued by United Nations Development Program (UNDP) and Global Environment Facility (GEF).The essence of the BRESL is to enhance regional energy efficient appliances markets though assisting promulgation or extension of energy efficiency standards and labelling in five selected south Asian nations. Pakistan has a well-established local and export market of electric fans. Hence, the government has instituted Minimum Energy Performance Standards (MEPS) through its BRESL allocation and has initially announced voluntary energy efficiency labelling on electric fans. The impetus of this research was to understand effectiveness of implementation of BRESL plan via behavioral analysis of stakeholders in market of energy efficient ceiling fans. A field survey and several interviews were employed to gather data from relevant governmental and non-governmental personnel, fans manufacturers, retailers and consumers. The findings revealed that government and non-government actors were pertinently involved and supported the BRESL market output of these fans. The industry however was parted into two factions over manufacturing of this appliance due to its high

production cost. The consumers were willing to purchase the efficient machine, if available in the market, while also considering its price and quality. The survey portrayed a general lack of awareness about energy rating and labelling of this device among consumers and some retailers. The consumers also doubted that the product labeling regulated at federal level will be genuinely implemented.

Farr, Claire, ES2

Cut the Waste: Lessons from Oklahoma's 20x2020 State Energy Program

This session will share lessons learned from the first two years of Oklahoma's 20x2020 Program, which was designed to help state agencies and institutions of higher education reduce energy consumption by establishing behavioral energy management programs. Originally derived from the strategic objectives in Governor Mary Fallin's 2011 Oklahoma First Energy Plan, the state legislature established the 20x2020 Program in 2012 and directed about 100 state agencies and institutions of higher education to participate. The program compiled the first resource in the state to ever centralize data regarding the varying energy consumption, per unit costs, and relative energy efficiency of the state's facilities, which have a total annual expenditure of over $100 million. The statewide program supports each organization in designating an energy management team and implementing a behavioral energy conservation campaign to meet its goals. This session will report observations and conclusions from ES2's work with Oklahoma's state organizations to inform those who wish to undertake behavioral conservation efforts in a similar environment. Attendees will learn what structural commonalities existed between those organizations that created sustainable energy management programs and those that struggled. The key differentiations between types of public organizations will be discussed, and common barriers to action in public agencies will be identified for future study and development.

Feygina, Irina, Climate Central

From Skepticism to Engagement: Making Climate Communication on Social Media Relevant to the American Public

The need to engage the public with issues of climate change is urgent. We examined the effectiveness of climate communication by local weathercasters via the Twitter social media platform in engaging the public. Weathercasters are perceived as trustworthy messengers about climate change, which points to the importance of encouraging and improving their climate communication. Contemporary weathercasting has increasingly shifted to social media platforms, but little is known about the prevalence and impact of climate change reporting. We examined if, when, and how local weathercasters choose to communicate with Twitter audiences about climate change, how the public responds, and whether linking climate change to impacts, health, and economic and systemic issues increases engagement. Data comprised 3.7 million weather-related tweets that received 13.9 million retweets via the 1,937 twitter accounts maintained by the 2,327 U.S. weathercasters. Our findings indicate that local weathercasters do communicate about climate via Twitter (albeit with great variability), which is received by the public with greater interest than general weather information. Importantly, messages that link climate change with political, economic, infrastructure, and health impacts receive significantly greater attention than messages that only address climate change. Timing of messages, as well as the geographic location and social characteristics of the audience, matter. These findings point to the effectiveness of linking climate change to areas of socioeconomic concern, and the importance of examining climate communication via alternate social media platforms, untraditional messengers, and in contexts that allow for bi-directional communication with the audience.

Folks, Jordan, Research Into Action, Inc.

Smart Grid Technologies and Services: Will Consumers Engage?

The evolution of the smart grid opens new opportunities for utilities to engage with their residential customers and opportunities for consumers to control their energy use. In a survey of 1,500 U.S. consumers' experiences and perceptions regarding smart grid-enabled technologies and services, we presented respondents with two conjoint exercises to assess holistically their interest level and decision making processes for participating in a smart thermostat incentive program and a time-varying rate plan. We compared the responses of consumers residing in states with established smart grid infrastructures (advanced) versus the responses of consumers residing in states without established infrastructures (control). Surprisingly, we found few differences between consumers in advanced states and control states – even though advanced states have experienced more customer engagement on smart grid-related topics. Rather, the attitudinal and demographic characteristics associated with five unique consumer segments explained the differences in consumer decisions more than their state of residence. Further, the interest in participating in either a time-varying rate plan or in smart thermostat program was greater than 60%. Therefore, although some consumers in every state surveyed are hesitant about smart grid-related technologies and innovations, many are receptive. Further, with careful attention to addressing consumers' concerns, many will likely find these technologies and services appealing. Top concerns of respondents included doubts about realized bill savings, potential first costs of the technologies, concern for controlling smart home features, and uncertainty about the technologies' operations and performance.

Frades & Ben Packer, Matt, Opower

Behavioral Energy Usage Archetypes Help Explain EE Program Savings Rates

For nearly 9 years, Opower's behavioral energy efficiency programs driven household savings of 1.5-2.5% on average. Opower has tested the predictive power of a wide range of household and demographic factors, finding that none consistently correlates with savings other than total usage; high users save more. Finally, more recently, Opower developed a way to extract behavioral patterns from energy usage data using machine learning. These patterns not only correlate with household savings but also give insight into the behaviors of residential energy users. The technique Opower developed automatically clusters households using their AMI-based daily load profiles. The resulting "archetypes" point to behavioral patterns. One archetype, for example, has usage peaks in the morning and evening; customers belonging to this archetype likely leave home for work during the day. The archetypes are correlated with demographic factors, but importantly it is the archetypes that predict energy savings while demographics alone do not. These archetypes can therefore be used to target households for participation in energy efficiency and demand response programs appropriately. To investigate why customers exhibit certain usage patterns, Opower analyzed large-scale customer survey data, finding that customers' energy-related habits, attitudes, intentions, perceived behavioral control, and perceived social norms (all dimensions of the psychological Theory of Planned Behavior) are the most reliable predictors of a customer's load archetype. Since these dimensions differ systematically by archetype, it may be possible to use a customer's archetype to infer how they think about energy and consequently target customers with more personalized, motivating savings messages.

Fredman, Daniel, University of Vermont

Town and Gown Energy Partnerships: Renters, Split-Incentives, and the Smart Grid

Investments in residential energy efficiency are made by property owners who stand to reap long-term financial benefits of cost savings from reduced energy consumption. There is, however, a split-incentive problem when residents who consume energy are renters; landlords often don't pay tenant electricity bills and therefore don't benefit from the known cost savings resulting from investments in efficiency. This is of potential concern to energy efficiency practitioners as the proportion of rented housing units grow nationally; new strategies must emerge to overcome the split-incentive problem. There are different strategies to address this market failure, but here we focus on one made possible by the smart grid: how do real-time feedback and incentives motivate tenants to become agents of energy efficiency, and is this a cost-effective approach for efficiency program managers and utilities? The results of a randomized controlled trial (RCT) are described in which renters are placed in one of three treatment groups: (1) in-home displays providing real-time cost and energy feedback; (2) socially-competitive incentives to change the timing and magnitude of energy consumption; (3) a combination of the two. The results of the RCT are used to assess the cost-effectiveness of these interventions in rental housing. Additionally, the process of creating and implementing the RCT is informative in that the RCT was part of a pilot implemented through partnership between a municipal utility and a local university funded by university green fees. Suggestions are offered on how efficiency practitioners can take advantage of these university-utility relationships in the future.

Gloede, Katherine, University of Virginia School of Architecture

Toward a Systems Approach to Climate Change in Cities: Bridging the Gaps Between Flood-Resistance and Energy-Efficiency for Multifamily Housing in New York

In October of 2012, Superstorm Sandy exposed significant structural vulnerabilities in New York City's coastal multifamily housing like no storm before it. Sandy's storm surge reached nearly 76,000 residential buildings. More than 70% of these residential properties in the City's floodplain are multifamily buildings, most of which were constructed prior to the addition of flood-resistance standards to building codes. Since Sandy, new government-led initiatives aim to flood-proof coastal housing. Meanwhile, other government-funded energy-efficiency upgrades lower the energy footprint of housing. These programs rarely overlap. Time and money spent upgrading the efficiency of buildings is potentially wasted if they are unable to withstand the next major storm. This is particularly problematic as extreme weather events like Sandy are predicted to increase in frequency and the City's population is growing. For multifamily buildings to reach peak adaptive capacity to a changing climate, retrofitting programs should dually reduce energy use and address weakness to extreme weather. A systems approach, which holistically examines the building as a system of interconnected functions, is essential to avoid needing to retrofit or repair buildings more than once. Data visualizations and maps in this presentation outline the disconnect between government incentives and funding opportunities toward energy-efficiency and flood-resistance for multifamily housing in New York City. Analysis of current practices provides evidence to support both the importance and untapped benefits of a government-led systems approach to retrofitting multifamily buildings.

Granger, Christine, Cool Davis

Certified Community Energy Ambassadors: Developing a Local Network of Support for Ongoing Action

Two non-profits representing local city and county governments have designed a community engagement program in which members of community groups (churches, neighborhood associations, parents with children at a local school, or virtual communities with a common interest) are trained to become Certified Community Energy Ambassadors. These Ambassadors are not chosen for their experience with energy efficiency, but for their ability to engage their community, their enthusiasm, and their persistence. They receive training from experts within the community on subjects like lighting, HVAC, and plug loads, as well as effective techniques for communicating technical information, and motivating community members to start it up, keep it up, and restart it when they get stuck. Trainees receive certificates for each training module they complete. They are then provided with a branded backpack and hat. The backpack is stocked with a binder of source materials and with simple tools such as measuring tape, calculator, temperature logger, and small hand-tools. In addition, they are given access to a community lending library of more expensive tools such as plug load monitors, and cameras. An active network is promoted, including the expert trainers, Ambassadors, and program planners. Due to their pre-existing networks and sustainability-oriented mission, faith communities were the groups chosen for an initial pilot, which is currently ongoing. This presentation will describe the program's design, the rationale behind decisions, and early lessons learned. It is expected that the program will go beyond the pilot stage within a year, reaching out to a larger number of community groups.

Greenberg, Allen, U.S. Dept. of Transporation/FHWA

New Car Insurance Models for Shared Mobility

The U.S. automobile insurance industry is struggling to keep up with trends in shared mobility. Companies are offering new usage-based insurance products that give car owners a price break for using their cars less. They are also providing insurance to a broad range of carsharing and ride-hailing service providers, and indirectly to their customers when they use such services. But the industry is not offering overarching consumer-focused products that provide customers who have assets, but do not own a car, the level of financial protection they desire in all instances when they are driving or riding in shared vehicles. This presentation will review the preexisting insurance products in the marketplace that come closest to addressing this need, with U.S. and international examples. It will then propose insurance companies offer a "true up" product for added coverage to individuals using a full range of carsharing and ridesharing services. Customers would pay a very small base annual fee and book all shared mobility services on a single insurance-company-provided platform, and the insurance company would charge an additional per-trip or per-day fee on top of the ridesharing or carsharing service cost for the added insurance coverage the customer desires (if it is more coverage than the service is providing). Also discussed will be car owners who make their vehicles available for peer-to-peer carsharing being allowed to drop personal-lines insurance coverage entirely, relying instead on the commercial carrier already insuring non-owner use of their vehicles to charge them hourly for personal coverage.

Grunwald, Alena, Ontario Ministry of Environment and Climate Change

Crowd Sourcing Low-Carbon Behaviour in Ontario

In April 2016, the Ontario Ministry of Environment and Climate Change teamed up with Ryerson University to host Climate Hack-to-Action: Unlocking a Low Carbon Future. The 48 hour design jam brought together students and young professionals into multi-disciplinary teams to problem solve one of our trickiest climate change challenges: changing human behaviour. Individuals are responsible for a large portion of overall greenhouse gas emissions through their everyday lifestyle; meaningful engagement with individuals and society can not only help reduce our collective carbon footprint, but is also essential to achieving widespread support for broad climate change actions. Through expert facilitation, user-centred design, motivational speakers, and competition, teams defined a specific climate change problem related to behaviour, rapidly generated ideas, and developed a practical solution, which they pitched to an expert panel of judges. The process resulted in a number of new ideas to empower people to instinctively reduce their carbon footprint and live a more sustainable lifestyle. The unique partnership model gave the provincial government access to an innovative solution process, connections with non-traditional stakeholders, and helped invigorate climate change policy discussions with a behavioural lens. Following the Climate Hack-to-Action event, the Ministry continues to work with event partners to integrate solutions into Ontario's approach to climate change, whether through government itself or through the work of external organizations. This presentation will profile Climate Hack-to-Action and how new partnerships and innovative processes can help governments tackle complex problems. Keywords: People-centred, engagement, solutions

Hanus, Nichole, Carnegie Mellon University

Applying Decision Science Methods to Commercial Building Energy Efficiency

Commercial buildings account for approximately 20% of total energy consumption in the United States. In recent years the federal government has expressed interest in reducing consumption in this sector, with President Obama announcing the Better Buildings Initiative in 2011 to make commercial buildings 20% more efficient over the next ten years. To date, however, only 4% of commercial building space has committed to this challenge. Current energy efficiency policy and incentive programs tend to target economic motivations, which may misalign with other potentially important motivations arising from situational factors, individual differences, and social context. Thus, in this research we ask: what non-economic factors play a role in commercial building energy efficiency investments? To answer this question, we interview 10

commercial building owners/managers (decision-makers) and 10 experts/consultants (decision-influencers) regarding perceived motives and barriers to energy efficient investments, decision-maker attributes, and the social context of the decision. Potential factors that emerge from the interviews, which are not yet heavily discussed in the energy efficiency literature, include owners/managers' resistance to change and the influence of investment funding origins on the decision. Our results also suggest potential heterogeneity in energy efficiency decision-making philosophies between the two groups. Interviewed owners/managers prioritize Corporate Social Responsibility (CSR) and prefer internal consulting (e.g. building engineers). Conversely, experts/consultants do not emphasize CSR and are more concerned with external policies. These findings suggest that accounting for the decision-maker and the social context in which decisions are made could enhance the design of commercial sector energy efficiency programs.

Hazard, Caroline, CSPA

Turning Ideas Into Solutions: An up-close look at JUMP, Oak Ridge National Laboratory's crowdsourcing initiative

Everyone can contribute to science. Whether it's with a novel idea or a passion for science, research skills or a collaborative spirit, everyone can contribute. This fact is the hallmark of Oak Ridge National Laboratory's (ORNL) JUMP crowdsourcing initiative: Join the discussion, Unveil innovation, Motivate transformation, Promote technology to market. With an eye towards achieving a sustainable clean energy future, ORNL is building the online JUMP community to connect Department of Energy (DOE) researchers to industry partners, small businesses, innovators, and end users. By organizing these connections around technical challenges from industry, JUMP is helping to accelerate the market transformation curve of energy-efficient technologies. Industry partners, including current partners A.O. Smith, GE Appliances, Honeywell, IntelliChoice and United Technologies Research Center, provide cash or in-kind awards for winning ideas. In addition, ORNL may provide in-kind technical support in the validation, testing, and prototyping of winning ideas. Today, JUMP is being run by five national laboratories, including Argonne National Laboratory (ANL), Lawrence Berkeley National Laboratory (LBL), National Renewable Energy Laboratory (NREL), Pacific Northwest National Laboratory (PNNL), and ORNL. With these labs engaged, JUMP is leveraging a wide variety of technical expertise and connection across the building sector. There are over 500 registered users on the JUMP crowdsourcing platform. Through upcoming regional events with industry partners, more innovators are expected to join. JUMP is proving that we can discover technology solutions by building connections with an open dialogue.

Hill, Heather, Queensland University of Technology

Insights from Therapists: Energy Conservation for Households on a Low Income

Author Name: Heather Hill Author Company: Queensland University of Technology Second Author's Name: Marcus Foth, QUT Design Lab Third Author's Name: Evonne Miller, Creative Industries Abstract Title: Shifting Beliefs and Values in Low-Income Households Towards Energy Conservation: Insights from Practicing Psychotherapists Abstract Text: Everyday people are inundated with messages that encourage them to believe they value consuming and achieving possessions, money, and status over affiliation. These messages can impact household's energy usage as energy intensive appliances and gadgets may be acquired to maintain image and feelings of connectedness. Few studies have examined the emotional and social experiences of low-income earners living in a material world and how it may influence their energy consumption. Practicing psychotherapists facilitate lasting change in self-beliefs and values of clients with multi-faceted situations. Eight practicing therapists with diverse backgrounds were presented with two scenarios describing typical low-income earner experiences from the literature (scenario 1: client given negative feedback throughout life, believed it and has low self-esteem, scenario 2: single mother on low-income living in rental property that lacks insulation and efficient appliances that leads to high energy bills and is stressed, lacks confidence in her ability to raise kids, pay bills or life in general) and interviewed to inquire how they stimulate change and how they might work to change energy behaviours. Results reveal four key factors that were described as essential to fostering change: develop trusting relationships and cultivate social support; question negative connotations, explore emotions, and positive review; reframe communication to activate people's intrinsic values; and inquire on most immediate needs, then facilitate self-reflection, and help people find their own solutions to save energy if it is a priority. Findings can be useful to governments and researchers towards developing more effective approaches that facilitate lasting energy conservation. Key words: low-income, energy, values

Hirayama, Sho, Jyukankyo Research Institute Inc.

Results from Japan's First Large-Scale Home Energy Report Pilot Study: Impact on Japanese consumers' awareness, motivations, and electricity consumption

While residential behavioral energy efficiency (BEE) programs have become increasingly common in the U.S. and elsewhere, there have been no large-scale test of the effect of home energy reports (HERs) in Japan. Seeking to learn from international best practices, Japan's Ministry of Economy, Trade & Industry (METI) recently commissioned Japan's first large-N randomized control trial (RCT) using Opower's HERs: a 40,000-household (20,000 treatment, 20,000 control) pilot study across Hokuriku Electric Power Company's service territory. This study's purpose was to measure the effect of HERs on Japanese consumers' EE awareness, motivations, and electricity consumption. Because Japanese households already use

less than half of the electricity of American households—and especially after nationwide voluntary reductions in residential energy consumption following the 2011 Tohoku earthquake and tsunami—some hypothesized that HERs would have less impact in Japan. Another held that Japanese social conformity pressures would lead to greater HER behavioral impact. Interviews were conducted to gauge reactions to sample HERs across 8 different demographic groups. Later, 40,000 households were randomly assigned to treatment and control groups. HERs were then mailed to the treatment group during Hokuriku's winter peak (December 2015 – January 2016), and results were measured via both a 1,500-household phone survey and a comparison of electricity consumption. Homes receiving HERs lowered their consumption 1.2% after two months compared to controls, leading us to conclude that feedback can still play a role in Japanese energy policies.

Ho, Justin, UC Irvine

The Impact of Smart Technology on Consumer Welfare

This paper uses Big Data resulting from a large randomized controlled smart grid trial which exposed households to varying types of dynamic rate structures in conjunction with different enabling technologies to evaluate the welfare impact of different dynamic rate schedules. The data analyzed in this paper is drawn from a large scale randomized controlled trial (RCT) of dynamic pricing for residential electricity consumers in a South Central US state. In this experiment 1682 customers were switched at random to a dynamic pricing structure and received four different enabling technologies. Of particular interest is the provision of a "smart" programmable communicating thermostat (PCT) to one of the treatment groups, which not only provides information on current prices and quantities of electricity, but also enables households to automate their responses to price changes. The experiment allows us to contrast household responses to dynamic pricing in the presence of a PCT to responses to other technologies which focus on information provision alone. Based on the experimental estimates we project the welfare cost to consumers resulting from increasingly real time price variation and contrast these with the resulting cost savings to the utility. The paper measures behavior changes related both to demand response and longer term energy efficiency resulting from dynamic pricing.

Horton, Gary, Horton Consulting

Commercial Recycling Programs: What Drives these Behaviors?

Communities looking for an effective and cost-effective way to engage more commercial recycling are up against some big market-sized barriers. This paper presents the results of three studies that conducted survey and statistical work to uncover the opportunities and barriers for more commercial recycling; the most effective programs nationwide; and detailed statistical work on the drivers leading to the most effective community uptake in commercial program development. • We conducted large-scale surveys of businesses in multiple communities, to examine their current recycling (and composting) behaviors, and the barriers and opportunities identified by different business sizes and types regarding adoption rates for recycling and organics behaviors. • Although the "usual suspect" barriers are certainly concerns (lack of space, not enough savings, management dis-interest, staff turnover, etc.), we identified a whole class of barriers that had not been previously identified, and identify what communities and businesses can do to get past these barriers and increase diversion behaviors. • We used cutting-edge techniques to explore the benefits and costs of an innovative urban core recycling program, computing a fuller valuation that dramatically changed the benefit-cost ratios identified by businesses, and their incentives and behaviors. • Using national data, we identified the "driver" factors in communities with strong business recycling programs. The drivers aren't what you might guess up front – landfill fees have very little relationship to these behaviors. Finally, we draw these lessons together to explore what drive commercial recycling behavior – from the businesses, from programs, and from the larger community sense, and provide tips to other communities on winning strategies.

Houde, Sebastien, University of Maryland

The Impact of Energy Education on Low Income Households: Evidence from a Randomized Field Experiment

Low-income households allocate a larger share of their disposable income to energy expenses than high-income households. As a result, policies that aim to internalize negative externalities in the energy sector are regressive. Every year, millions of low-income households cannot afford energy services, fall into arrears, and end up at risk of being disconnected. Across the country, non-profit institutions help families struggling to pay their utility bills by providing small grants to low-income households that have received a disconnection notice from their utility. Though bill assistance plays an important role, it is a last resort solution to maintain energy services and does not address the long-term issue of how to help low-income households cope with high and often increasing energy bills. Policies that help families reduce their energy demand can thus potentially play an important role in this context. One such policy is energy education. Using a randomized experiment, we investigate the impact of energy education provided to low-income households that face the risk of disconnection from their utility services. Our first goal is to evaluate whether energy education can lead to a decrease in energy demand. Our second goal is to investigate the effectiveness of different educational technologies, particularly comparing online education to in-person programs. Finally, we also investigate the factors determining whether households will successfully complete energy education programs. Overall, our study provides important insights, both in terms of methods and lessons learned, for practitioners and academics.

Huckett, Jennifer, Cadmus

Energy Savings from Utility Customer Engagement Web Portals: Xcel Energy's My Energy Program

Many residential utility customers can now find personalized analyses of household energy use, learn about energy efficiency rebates, and receive personalized tips for saving energy by logging into utility web sites. As they not only increase engagement with customers but also educate and inform them about their energy use and encourage them to save energy, such web sites represent one of the newest forms of behavioral efficiency. In 2014, Xcel Energy launched My Energy, an Opower web engagement platform for residential customers in Colorado, Minnesota, and New Mexico. Soon after regulators approved My Energy as a DSM option, Xcel Energy contracted with Cadmus to evaluate the energy savings from My Energy between August 2014 and December 2015. Opt-in behavior-based programs such as My Energy present evaluation challenges because the decision to log in is affected by factors that researchers cannot observe and that may be correlated with future energy use. To estimate savings, researchers must rely on quasi-random variation between customers in the decision to log in while controlling for factors that might affect both the log-in decision and energy use. Cadmus used propensity score matching to construct a synthetic control group for My Energy login customers and estimated the gas and electricity savings using panel regression. Customers who logged in to My Energy saved an average of approximately 1% of electricity consumption and about 1% of gas consumption. This research will be of interest to behavioral researchers and utilities alike because the introduction of web engagement tools provide a new form of behavioral efficiency that many utilities are using to engage customers.

Hudson, Rebecca, U.S. EPA

Motivating Employees to Take Action at Home

Struggling to get your employees to save energy at home? Companies already engaged in energy efficiency at a corporate level are often interested in helping their employees make a difference at home. Similarly, communities such as towns or congregations may want to improve residential energy efficiency. What are some motivational options that do not require significant resources to implement? The EPA recently re-launched its ENERGY STAR Home Advisor to help meet the needs of homeowners interested in tracking their home's performance over time in their own account as well as stakeholders interested in a ready-to-go kit to educate and empower homeowners to improve their energy efficiency. This presentation will cover how the Home Advisor has helped track and motivate employee behavior at home through education and competition. The Home Advisor allows homeowners to get recommendations for where to start with improving their home and taking action, track their progress, compare themselves to others and get customized messages from their community as well. EPA launched a pilot project in 2016 and by the time of the BECC conference EPA will have results that include: 1) Feedback from employees and the companies on their experiences, 2) Metrics of engagement level, 3) Qualitative changes in engagement vs previous engagement strategy without use of the Home Advisor platform. From corporations to towns – come find out more about how using a free tool to engage in education and competition can lead to increased engagement and actions taken.

Hung, Der-Fang, Industrial Technology Research Institute

An Integrated Framework to Untangle the Decision-Making Process of Energy SMEs

Small and medium-sized enterprises (SMEs) consume more than 13% of total global energy demand collectively (International Energy Agency, 2015), but receive not enough attention due to their diverse decision-making mechanisms. To accelerate energy efficiency of SMEs, we developed a framework to integrate the diverse decision processes and conducted an empirical study in Taiwan. The integrated framework postulates that company credo influences the formation of routines, and the routines, in turn, determine the adoption of energy-saving behavior. In the while, energy-saving knowledge, participation level in energy-saving initiatives, energy-saving difficulties, and energy-saving incentives are moderated factors. In the empirical study, 2,000 valid questionnaires were collected from local SMEs and the hypotheses derived from the framework were mostly supported by statistical tests. In this study, the companies were divided into four types based on their credos: green-principled, self-duty, efficiency-focused, and economy-oriented firms. Green-principled firms had the highest participation level of energy-saving initiatives, the highest energy-saving incentives and the best behavior of equipment update, but they encountered the most energy-saving difficulties. Self-duty firms had the most energy-saving-related routines and the best behavior of energy management. Economy-oriented firms possessed the most energy-saving knowledge but were the most eager for government's assistance. Efficiency-focused firms had the lowest energy-saving knowledge, energy-saving related routines, energy-saving incentives and the worst behavior of equipment update and energy management. There are at least three implications from the investigation. First, the credo-routine-behavior model is the one on which core decision-making processes of SMEs are based. Altering the company credo could change the company behavior. Second, energy-saving knowledge, incentive, difficulties and initiative are the moderated factors. Manipulating these moderated factors alone could not induce the energy-saving behavior in SMEs. Third, government should design a package of energy-saving policy for SMEs with different credos. For green-principled firms, how to reduce energy-saving difficulties is the key to the policy design. For self-duty firms, how to raise the ratio of equipment update is core of the policy package. For economy-oriented firms, how to facilitate the formation of energy-saving related routines is the policy pivot. For efficiency-focused firms, how to enhance the energy-saving knowledge is the critical policy direction.

Hyde, Julie, Duke Energy

Duke Energy Smart Energy in Offices -Year 2

Duke Energy's Smart Energy in Offices (SEiO) program incorporates deep building operator engagement and occupant behavioral action campaigns into a unique commercial behavioral program and serves as a model for other "two-pronged" operator and occupant behavior change programs. The SEiO program design is based on best-in-class strategies and insights such as commitment, feedback, benchmarking, peer-to-peer and community interactions, competition and recognition to drive behavior change. In the program's second year, close to 200 large office buildings have enrolled in greater Charlotte, NC, Durham, NC, Winston-Salem, NC, Greensboro, NC and Greenville, SC. With a heavy focus on building operator and tenant engagement, key program tactics employing social science insights and behavioral engagement strategies are implemented, including: in person interaction with program staff, automated benchmarking through integration of the Smart Energy HQ platform with Energy Star Portfolio Manager, operator behavior change campaigns, tenant behavior change campaigns, building operator networking, competition and recognition, energy use feedback, and community comparisons. By gathering customer feedback and through continuous improvement, we continue to enhance the program to offer increased value to the participants. We would like to share with the BECC community specific examples of program design enhancements such as the community wide Add It Up campaign, unique marketing strategies, and leveraging university partnerships to connect building operators with students. We will also share key insights, successes and challenges, customer feedback and participation metrics.

Ignelzi, Patrice, Applied Energy Group

Using One Program for Multiple Resource Savings in Multi-Family Complexes

Energy efficiency and water conservation programs that encourage behavior change among residential customers, especially those in single-family homes, are common. And, even as new intervention strategies are introduced, most target these same customers. Now a group of utilities and water agencies have come together to offer a new type of program to a market that has rarely been targeted: whole multi-family complexes. While most programs target either tenants (within broader residential programs) or building owners/managers (generally classified as commercial customers), the "unit" is the entire set of tenant and common area accounts. It gained regulatory favor when proposed because of two groundbreaking characteristics: targeting whole multi-family complexes (rather than individual customers) and the partnership of electric utility, gas utility, and all the water agencies that serve the targeted group to generate savings in all 3 types of resources jointly. The presentation will address the challenges and resourceful solution to aggregating accounts to the whole-complex level, and describe the experimental design strategy it will employ: randomized encouragement design (RED) within a randomized control trial (RCT). This presentation is well suited for BECC because the program aims to generate savings in multiple resources, for a relatively untapped portion of the residential sector, using a unified strategy. By offering multi-resource savings opportunities within the same program, the partners will facilitate savings and reduce the cost of engaging customers. And, finally, the innovative solution to aggregate accounts to the whole building level is timely because an increasing number of states are adopting requirements that utilities provide whole-building usage data to customers for benchmarking purposes.

Isley, Steven, NREL

Determining Optimal Carbon Display Properties: How the Presentation of Information Influences Willingness to Pay for Carbon Reductions

Consumers and policy makers are demanding more information about the environmental impact associated with different goods and services with the idea that more information will lead to better, more informed choices. However, the way in which that information is conveyed to individuals can have a dramatic effect on the weight individuals give greenhouse gas reductions. Surprisingly little research exists on how best to display carbon footprint information in various decision contexts, such as purchasing products in a grocery store or informing individuals about the carbon impact of their commute. Our preliminary results indicate that a properly designed display method can increase the average willingness-to-pay for carbon reductions by a factor of three. We use insights from behavioral psychology to decompose display methods into attributes such as familiar vs. unfamiliar units, scaling method (nominal, ordinal, interval, and ratio), visual vs. verbal imagery, positive vs. negative framing, and the presence or absence of contextual information. Display methods spanning this attribute space were developed and tested using online survey tools across a range of goods and services. For each good or service, a discrete choice experiment was conducted to quantify the willingness to pay for carbon reductions. We present experimental results, offer a set of general recommendations about how to display carbon information across a wide range of decision contexts, and provide the underlying code to quickly determine the appropriate display method for contexts not covered by our analysis.

Jaeger, Christine, California State University, San Marcos

Effect of Social Norms and Commitment on Residential Water Conservation

Southwestern U.S. climate projections are clear: our warming climate reduces water availability, while simultaneously requiring increased water supplies to meet existing demand. Given the interdependence of energy and water systems, issues of water scarcity go beyond the water sector, threatening reliable energy production. In arid, urban areas, managing residential water demand will be critical to mitigating supply variability. Social influence strategies have shown promise in increasing pro-environmental behavior across various domains, including water. The current research investigated the impact of coupling normative information with commitment-making on residential water consumption; 8,876 households were randomly assigned to receive either information concerning water restrictions, details regarding penalties associated with violating restrictions, or normative information communicating community compliance to restrictions. Subsets of households in the latter two conditions were asked to commit to adhering to water restrictions. Because we expected that normative information would not impair voluntary commitment-making, we hypothesized that the normative information plus commitment condition would result in more durable water use reductions. This prediction was supported. While both conditions of committers (strong warning and normative information) evidenced immediate reductions compared to the control, (respectively, -5.3% or -19.65 average daily gallons per household [GPH] and -3.4% or -12.73 average daily GPH), only the group of committers who received normative information maintained reductions (-7.6% or -19.83 average daily GPH). It appears that normative information does not negatively affect the voluntary nature of commitment-making; these findings establish the potential to leverage social norms to motivate high-users to engage in a commitment-making intervention. Keywords: social norms, commitment-making, water conservation

Johnson, Emma, City of Bellevue

Behavior Change for a City: Urban Smart Bellevue

The vision: a downtown district in which smart people create a movement toward smarter buildings and business practices. In Bellevue, WA technology, communications, facilities management, and individual & collective actions are working together to cut operating costs while reducing the consumption of energy resources. Urban Smart Bellevue is leveraging community-based social marketing, energy tracking software, and a heightened interest in sustainability to change behaviors around energy efficiency in the downtown core. Traditional commercial efficiency programs promote energy efficiency through things like more efficient lighting, boilers, and insulation. These programs generally engage building operators and owners, leaving the building occupants unaware of their impact on energy performance. New programs combine elements of traditional program models with a focus on occupant behavior to accomplish more. Puget Sound Energy (PSE)'s Urban Smart Bellevue program uses an Energy Management Information System (EMIS), a proven organizational behavior change approach with Strategic Energy Management (SEM), and community-based social marketing (CBSM) to drive reliable energy savings with the largest 200 businesses of the Bellevue urban core. This program seeks to prove that these combined strategies can produce cost-effective savings, while creating more robust customer relationships. This presentation will describe the approach, program design, how businesses and stakeholders have been engaged, and the initial results from the program's first year. The audience will learn how they may similarly combine program elements into a compelling and far-reaching program for their metropolitan area.

Kaplan, Mike, Ecova

Driving Behavioral and Operational Savings in Commercial Buildings for the Maryland Energy Administration

As commercial energy efficiency programs mature, it is critical for utilities and customers to tap into new types of savings opportunities. For example, operational savings account for 40-50% of the savings potential in commercial buildings, but only represent a small fraction of efficiency program goals. The ability to accurately measure performance and gain confidence in realized savings is a critical step to making these programs a reality. Deep meter analytics are being touted as an approach to achieve and verify building-level savings at a scale and low cost not possible with traditional approaches. In this presentation, Retroficiency and Montgomery County Public Schools (MCPS) will demonstrate how they are leveraging meter data-driven analytics to unlock operational savings in schools, without the need for costly capital investments or upgrades. These results occurred as part of a pilot program run by the Maryland Energy Administration on behalf of the utility PEPCO based in Washington, DC. Retroficiency worked with MCPS and its energy management team – which oversees more than 200 schools – to isolate buildings with the greatest operational savings potential and provide specific recommendations for each building. After analyzing whole-building interval meter data, Retroficiency identified approximately 2.2 million kWh in annual savings potential, with 1.2 million kWh (53% of the total) in no-cost operational savings. Retroficiency scoped and implemented these measures on a largely remote basis with virtual energy assessments and low-cost M&V software. Participating schools experienced an average savings potential of 13%, along with the potential for large spillover effects into other schools.

Katzman, Alex, Enervee

Using an Online Marketplace to Boost Participation in Residential Plug Load Appliance Programs: Lessons Learned from PG&E, Snohomish PUD and LADWP

Utilities often provide incentives to their customers in the form of rebates for purchasing more energy efficient appliances. Rebates often carry a negative stigma and many consumers feel they are more hassle than they are worth - hard to find and difficult to receive payment for. How can utilities encourage broader participation and realize greater savings by changing the way they communicate to customers? Enervee has been partnering with innovative utilities across the US such as PG&E, Snohomish PUD and LADWP to offer their customers a better experience for purchasing energy efficient appliances, electronics and lighting by using highly targeted digital marketing and an online Marketplace with integrated incentive redemption. By presenting customers with timely, emotionally engaging ads and email marketing, we are able to capture online shoppers that may not be digitally engaged with their utility. We then overhaul the rebate process to simply require emailing in a receipt and filling out a short online form, enabling customers to claim an incentive in minutes. Additionally, positioning the incentive as a "reward", which can be a combination of smaller cash payments and/or an EE kit, instead of a "rebate" has shown promising results in driving higher incentive volume and more cost effective savings. Finally, we will showcase how Sweepstakes and other exciting online strategies can be a game changer for driving energy savings in electronics and other hard to address categories.

Kaufman, Jason, SEE Change Institute

Tips for Tips: Effective Strategies for Presenting Behavioral Recommendations

Behavioral recommendations, or "tips," are one of the most integral pieces of EnerNOC's Business Energy Reports (BER), a central deliverable in their attempt to reduce energy consumption among commercial clients. These tips often provide actionable insight, rough estimates of expected savings, and relevant next steps. Though information is known to be a critical component of effective interventions, there is little actually known about the most effective strategies with which to present these tips. This report synthesizes the findings from a number of collaborative online and usability studies. These studies measured the impact of variations of different components of tips, with the goal of optimizing messaging to incite pro-efficiency behavior in the BER recipients. In synthesizing these findings, we provide a rigorous and thorough examination of effective tip construction and presentation including insights on tip content, form, structure, and imaging.

Kelman, Anita, Capstone Community Action

The Use of Efficiency Coaching to Create Behavior Change in the Low-Income Sector

In 2011, Capstone Community Action's Low-Income Weatherization Program received a DOE SERC grant. This grant was for two activities: installation of solar thermal and water heating panels, and to develop and implement an Efficiency Coaching program. The coaching program was to be based on Community Based Social Marketing (CBSM) techniques. All five Weatherization programs across Vermont received this grant. Over 1000 clients received Efficiency Coaching visits or informational sessions by the end of the grant in June 2012. The Efficiency Coaching program has been adopted by the Office of Economic Opportunity (OEO), the state entity that oversees Vermont Weatherization programs, which has mandated that all clients receive the coaching visits. At present, there is an Energy Efficiency Coach (EC) in each Weatherization program. Clients are visited by the EC as the first step in the Weatherization process. Along with assessing the home for issues that will impede Weatherization, clients receive coaching in areas including furnace care/operation, thermostat setbacks, moisture/mold prevention, CO/Smoke detectors, electrical efficiency measures and other areas. Materials are installed as applicable. Response has been very favorable, and adoption of new behaviors such as changing furnace filters and monitoring home humidity have been documented.

Kim, Yeong Jae, Georgia Tech

The Effect of Gasoline Prices on the Willingness to Consider Fuel-Efficient Vehicles

This paper fills the gaps in the understanding of the relationship between the future gasoline price perception and the willingness to purchase vehicles, especially, more fuel-efficient vehicles and electric vehicles. Previous studies argue that the impact of higher gasoline prices on purchasing fuel-efficient vehicles not be as significant as once thought. This study proposes the application of the survival analysis which shows that the evidence is statistically significant on the willingness to purchase electric vehicles. Higher gasoline price perception plays a significant role in considering electric vehicles. However, I do not find any statistically significant evidence that higher gasoline price perception positively affects the willingness to consider more fuel-efficient vehicles. Consumers are reluctant to buy fuel-efficient vehicles unless the return is sufficiently high and the payback time is short.

Klein, Sharon, School of Economics, University of Maine

What are the financial and social costs/benefits of different community solar approaches?

Community solar is rapidly growing in the United States and has the potential to expand the solar market to customers without the means to install individual residential/commercial solar, as well as to encourage solar technology diffusion through peer effects. In addition, many states in recent years have been introducing legislation to incentivize community solar through rebates, virtual net metering, tax policies and other mechanisms. However, very few studies examine the costs and benefits of different community solar approaches, and no published studies compare the financial and social

benefits and costs of different community solar typologies for individual participants and groups. Drawing from an original, national dataset of more than 5,000 projects, we define 3 main community solar typologies (shared solar (e.g., solar farms/gardens), bulk purchase groups (e.g., Solarize, solar cooperatives), and community-serving institutions (e.g., municipalities, houses of worship, schools)). We examine trends in number of projects, installed capacity, and organizational/financial structure by state, and report the results of a tri-state (Maine, Massachusetts, and Vermont) survey of project participants to compare across typologies and states: 1) organizational and financial structures; 2) individual and group motivations and decision-making processes; 3) financial impacts (e.g., upfront cost, annual savings, net present value of investment, payback period); and 4) social impacts (e.g., time commitment, emissions savings, learning, rollover energy behavioral changes, community building).

Kontou, Eleftheria, University of Florida

Socially Optimal Replacement of Conventional Vehicles with Electric Vehicles for the U.S. Household Fleet

This study proposes a framework for minimizing the societal cost of replacing gas-powered household vehicles with battery electric ones. Social cost is decomposed to account for household drivers' heterogeneity due to their daily driving patterns and pre-owned vehicle conditions, government investments for charging infrastructure deployment, as well as monetized environmental externalities. The program determines the timeframe needed for conventional vehicles to be replaced with electric ones. It also determines the all-electric driving range that should characterize electric vehicles during the planning timeframe and the evolution of the public charging density deployed by the government on a linear city. The framework is applied with datasets that represent US households, automobile, and energy market. Results indicate that, it takes 8 years for 80% of our conventional vehicle sample to be replaced with electric vehicles under the base case scenario. Socially optimal all-electric driving range is 204 miles, with chargers placed every 172 miles in the linear transportation network. All the public chargers should be deployed at the beginning of the planning horizon in order to achieve greater savings as the years go by. Sensitivity analysis reveals that the timeframe for the conversion of 80% of the sample varies from 6 to 12 years. The optimal decision variables are sensitive to battery pack cost, gasoline cost, discount rate and current conventional vehicles' fuel economy. Faster electric vehicle diffusion is achieved when the gasoline cost increases, electricity cost decreases and battery packs are cheaper.

Kruke, Laurel, Pierce Energy Planning

Helping School Save Through Energy Behavior Programs

The EPA notes that schools can see a 25% reduction in energy use just through behavioral and operational changes. Successful energy management programs in school districts get all stakeholders on-board and inspire them to change their behavior. Creating an energy policy and usage guidelines can help district administration show their commitment to saving energy. Guidelines highlight key strategies that staff, teachers, and students can implement to reduce energy use on their campuses. Conducting energy trainings with key staff members can help them become energy champions, and in turn, encourage students to work on initiatives that engage the broader school population. This presentation will highlight case studies from Arizona public schools that include these different behavior components of an energy management program. One elementary school district reduced their electric usage by 26% over the first two years of their program by creating an energy policy and use guidelines that staff, teachers and students put into action. Another school district shifted temperature set-points in their schools to be more conscious about energy demand (kW), and saved significantly on their electric bills. A third school district is seeing energy use decrease by as much as 15% every month after conducting professional development with teachers, who then were tasked with incorporating energy into their lessons and engaging students on Green Teams at their schools. These districts are seeing significant energy savings by working with the people in their schools, and shifting behaviors to be more energy (and cost) efficient.

Kuntz, Kathy, Cool Choices

Just Do That! Targeting Behaviors that Represent the Best Savings Opportunities

There are a myriad of sustainable practices individuals could adopt to reduce their emissions. Implementers have limited time and resources so it is important to target the best opportunities—assuming we know what those opportunities are. Is it easier to motivate individuals to wash clothes in cold water or to shut off the television when no one is watching it? Which sustainable habits are already widely practiced? Are some individuals more likely to adopt sustainable driving behaviors over household behaviors associated with energy or water usage? Are there behaviors that can act as 'gateway drugs', leading to other sustainable practices? Most importantly, which behaviors offer both substantive savings opportunities and a high likelihood of broad adoption? Via its employee engagement game Cool Choices has collected nuanced behavioral data from thousands of individual households. Households participating in our games report—often on a daily basis—their practices, indicating existing habits as well as new behaviors. More, when coupled with pre and post-game survey information, we can tie participation trends to demographics and attitudes. In this presentation Cool Choices will present a meta-analysis of the data collected from multiple games in 2015 and 2016 across a variety of companies and communities. We will delineate our findings relative to the elasticity of various behaviors, the demographics

of households adopting specific behaviors, and the interconnection between some behaviors. Session attendees will be able to use the information presented to strategically target their own initiatives to easily-adopted, high impact behaviors.

LaValle, Alicia, CALP, UNIVERSITY OF BRITISH COLUMBIA

A Place-Based Educational Videogame on Climate Change: Future Delta 2.0

This presentation summarizes findings from a cumulative case study of a unique cluster of research projects evaluating the effectiveness of various community-scale interventions on energy and climate change solutions in British Columbia, in shifting public attitudes, behaviour change, policy change, and achieving measurable results including GHG reduction and energy savings. It reviews eight research projects commissioned by the Pacific Institute for Climate Solutions (PICS) to develop and empirically evaluate tools and processes to engage the public, or retrospectively review home retrofit/renewables initiatives. Approximately 3,000 citizens participated in these social mobilization activities including Vancouver's Greenest City Program, the Solar Colwood program, and university energy-saving campaign ('Do it in the Dark'). A new evaluation framework is used to compare findings across research projects and identify patterns in methods, goals, and planning contexts. It highlights differences between 'top-down' government processes, grass-roots initiatives, and 3rd party processes targetting stakeholder groups. The case study demonstrate successful social mobilization at multiple levels, including three cases achieving substantive energy savings/GHG reductions through collective action and behaviour change over 1- 18 months. Many of the research projects reported shifts in concern, attitudes, or motivation, and increased understanding of co-benefits of climate action. The study found evidence for the effectiveness of innovative visual/social media such as interactive touch-tables, neighbourhood visualization with energy modelling, and facilitated social media processes for energy/transportation planning. It also documents failures of local energy initiatives, and discusses study implications for best practice. KEY WORDS: Social mobilization Community energy Digital media evaluation

Leong, Waiyan, Land Transport Authority

Impact of a Daily Season Parking Scheme on Car Park Usage at the Workplace

A daily season parking (DSP) scheme was introduced at the Singapore Land Transport Authority (LTA) from August 2013 as part of efforts to encourage staff to use public transportation to work. The DSP scheme contrasts with the existing monthly season parking (MSP) scheme in that the DSP charges users for every day that the car park is used, while the MSP is effected on a monthly basis via payroll deductions. The idea of making season parking more responsive to usage draws from behavioural insights that upfront irrecoverable costs increase the tendency for people to consume a good or service more than they otherwise would. In other words, a MSP scheme is suspected of inducing a higher rate of car park usage (and car commuting) than a daily-rated one. Supporting this hypothesis, we find that there is a reduction in car park usage of about four days among the MSP holders who opted to convert to DSP, with the reduction in car park use becoming evident very quickly after the decision to convert. We also conducted a field trial at a different location to examine the relative effectiveness of a daily rebate scheme, where every day of non-car park use is rewarded by a rebate off the monthly car park charge, to a more traditional daily charge scheme. It appears that the daily rebate scheme is weakly more effective than the daily charge in discouraging car park use.

Loomis, Jen, Research Into Action

Engaging Local Governments to Prioritize Energy Efficiency and Climate Action Planning: Lessons from utility-government partnerships

Local governments are uniquely positioned to address climate change through enacting policies and leading by example to accelerate energy efficiency in their communities. Yet, encouraging such behavior among local governments has been challenging because local governments operate in fiscally constrained contexts and must prioritize spending on staff salaries and key services, such as public safety. The presenters, through recent program evaluations and a review of industry literature, have identified key factors that motivate staff at local governments to engage in behaviors that stimulate energy efficiency policies and activities in their communities. The authors will explain key program elements that help local governments overcome constraints and build capacity to prioritize climate action planning and energy efficiency. These factors include: 1) peer-to-peer competition and social recognition of accomplishments; 2) access to a "support toolbox" that includes low-to-no interest financing options and technical engineering services; 3) regular networking and sharing of best practices; and 4) the ability to leverage program offerings to address local needs. These findings derive from a variety of programs and municipalities, exhibiting a range of population sizes, urbanization levels, and climates, making the findings transferable to other states and communities. Attendees will leave the session understanding the role local governments play in addressing climate change, with an emphasis on how program designs can activate staff and decision-makers at local governments by supplying motivators and overcoming barriers. 3 Key Words: Local government; partnerships; energy efficiency

Lopes, Marta, IPC-ESAC, INESC Coimbra

Which Buttons Should We Push to Maximize Energy Savings?

Energy behaviors are currently recognized as a cornerstone of a more energy-efficient and lower carbon future. However, dealing with energy behaviors is a complex task since they hold multiple dimensions (e.g., usage, investment, maintenance and provision of energy services) and are influenced by numerous variables of the personal, contextual, and technological domains, thus making the design of effective energy efficiency programs more challenging. This work presents an integrative multidisciplinary approach developed to support the design of an energy efficiency program in Portugal. Methods and techniques from engineering, social sciences and humanities were combined to assess the qualitative and quantitative influence of behaviors on energy consumption and identify the most relevant factors to be addressed to promote savings. A set of 450 households was used as case study. Household's energy consumption was monitored using a smart meter and web-based surveys to assess environmental (e.g., physical and socio-economic environment), structural (e.g., building and equipment characteristics), contextual (e.g., household socio-demographic characteristics, activities) and personal factors. Results from this study not only confirmed the significant impact of usage energy behaviors on energy consumption, but also of other variables associated with different dimensions thus supporting the need to use integrative approaches to tackle energy efficiency in the residential sector. In this case study, energy savings increase by promoting both structural actions and energy behaviors, namely a better insulation of the dwellings, and encouraging specific usage energy behaviors, such as the adjustment of appliances settings and the efficient use of washing appliances.

Love, Peter, York University

Lessons Learned from Past Behavioral Change Initiatives

LESSONS LEARNED FROM BEHAVIOR CHANGES IN THE PAST The behavior as well as the physical features of humans, like all other forms of life, have and continue to evolve. While many of these behavioral changes can be considered natural, some were the result of direct intervention by society to change a particular behavior or set of behaviors. As has been noted by many historians, learning form the past can help us better understand ourselves. In terms of energy and climate change, better understanding past conscious efforts to modify human behavior can help us better understand how to design policies and programs to change the behavioral aspects of energy consumption by individuals and organizations. In the last 100 years, there have been many such interventions. While some have been largely driven by regulations and punishment (for example wearing seat belts and assigning a designed driver), others were driven by more social pressures (for example anti-spitting after World War 1, residential curbside recycling programs and rights of non-smokers). This presentation will summarize the main features these five behavior changes and focus on the lessons that can be leaned and applied to behavior change as it relates to energy consumption and its related impact on climate change. This research is being undertaken as part of a senior level university text book that is being written on Energy Efficiency Policy. The author has direct experience with two of the previous interventions (recycling and non-smokers rights) and has focused on "Creating a Culture of Conservation" for the last 10 years.

Luboff, Jay, Navigant

Commercial Strategic Energy Management Program – Best Practices and Approaches

Commercial Strategic Energy Management Program – Best Practices and Approaches It is a well-known adage that focused intent gets results! Nowhere is this more relevant -- or more important to the efficiency industry -- than in a well-organized and implemented Strategic Energy Management (SEM) programs. SEM programs build lasting partnerships among program administrators and their commercial customers and empower the customers to make smart energy decisions for their facilities. Focused on operational and process improvements, on identifying untapped capital projects and on people engagement, SEM efforts lead to deeper and long-term savings. As SEM begins to take hold in the market, similarities and differences are beginning to show up between program administrator efforts. Recently, Navigant conducted a Commercial SEM Best Practices study for a leading mid-west utility to identify the key drivers to success and approaches to effectively engage varying customer types or needs. This presentation will focus on study findings from the in-depth research and interviews with the leading SEM program providers around the country. Our findings address the advantages and limitations of various Commercial SEM program models and targeted business types. The study identifies the elements and strategies that are critical to successfully implementing an SEM program, including project planning, people engagement, persistence of commitment and measurement and verification. We also present a roadmap for program operation in the form of a best practices logic model, drawn from interviewees, which program administrators can use as an example to design and operate their own SEM program.

Lupkin, Lea, Yale University / SEE Change Institute

Look Before You Leap: Leveraging Landscape Analysis as a Method For Behavioral Program Selection, Design, and Improvement

The role of behavior in energy programs has grown dramatically over the past two decades, prompted by policy pressure, research insights, and private innovation. While this growth has resulted in energy savings, even deeper savings could be

achieved through a more systematic application of behavioral science insights. In evolving from an ad hoc to a systematic approach, a landscape analysis of behavioral programming provides a bird's eye view for organizations experimenting with behavioral strategies. To identify and assess the landscape opportunities for one western utility, SEE Change Institute (SCI) conducted a program inventory of current behavioral energy programs at Pacific Gas and Electric (PG&E). The study analyzed 16 programs that reach over 1.5 million residential, small-medium business, and commercial & industrial customers. The inventory included both energy efficiency and demand response programs. Individual case studies were developed with recommendations for each program. Drawing on the broader landscape of behavioral theory and evidence, a synthesized analysis of gaps and opportunities across programs was conducted. This paper presents the synthesized findings to increase existing program reach and conversion and to test entirely new programs. The landscape analysis is a tool for program selection, design and optimization. While the study was designed for one utility, the methodology and findings have implications for other utilities and organizations seeking to advance to the next stage of applying behavioral insights. The landscape analysis approach is the first critical step in developing a systematic application of behavioral insights for deeper energy reductions.

Lyon, Erik, EMI Consulting

Leveraging Benchmarking Data for Behavior Change

Building energy benchmarking ("benchmarking") policies promise to contribute to energy and carbon emissions reductions by changing the behaviors of owners and other stakeholders. However, energy use intensity (EUI) and the ENERGY STAR score, the two central metrics of the EPA's Portfolio Manager, remain difficult to engage with and understand. Working with the cities of Seattle and Boston, the authors have found that these metrics can be made more meaningful to stakeholders using the rich characteristic data collected through Portfolio Manager. Benchmarking metrics can be made relevant to stakeholders with the appropriate context and visualization. Building stakeholders need relevant comparisons to peer buildings to make sense of their data, so understanding basic drivers to energy consumption is key. After the building type, secondary spaces were found to be most important to understanding energy consumption. Providing an EUI relative to a group of comparable peer buildings or by controlling for secondary spaces allows building managers to understand their relative performance. Visually representing energy consumption can also help stakeholders understand relative building performance. The authors assisted Seattle in creating a benchmarking dashboard where building stakeholders can compare their EUI and ENERGY STAR score with those of other similar buildings. The dashboard shows both metrics relative to the distribution of other comparable buildings in the dataset. We discuss the importance of the data quality for the relatively few fields needed to create meaningful results for the above strategies, and conclude with recommendations of how communication of performance metrics could be improved in the future.

Machak, Christina, Center for Sustainable Energy

Understanding the Impact of Time-of-Use Electric Rates at the Household Level

The three California investor-owned utilities (IOUs), which serve about 80% of California's residential electric customers, are preparing to transition the majority of their residential customers to time-of-use (TOU) rates in the coming years. As early as July 2017, households that go solar will be required to switch to TOU rates; TOU will be the default rate for nearly all other residential customers beginning in 2019. Much of the past investigation of TOU rates in California has focused on large-scale (e.g. state or utility territory level) analysis of the costs and benefits of rate restructuring. Our research is focused on the single-family household level and adds an important perspective to the ongoing policy debate. For residential consumers, several important questions remain unanswered. How will a household's electric bill change under the new rate structure(s)? How will the bill changes affect the value proposition for other energy saving measures (e.g. home retrofits or smart appliances)? How will the rate-restructuring affect homeowners with solar and those interested in installing rooftop solar or energy storage? Will vulnerable populations (e.g. the elderly who remain at home during peak load hours, low and moderate income families living in older, less energy-efficient homes) see an increase in their bill? This research explores these questions using case studies and modeling of electric consumption at the household level using a data set of several hundred homes in California. This rich dataset consists of two years of electric consumption at 15-minute resolution as well as detailed building and occupant characteristics.

Maness, Michael, Oak Ridge National Laboratory

Social Adoption of Plug-in Electric Vehicles: Modeling and Policy Review

In the past, research on new vehicle technology has focused on the attributes of vehicles such as fuel economy and refueling range. However, new vehicle technology is inherently unfamiliar to the general population. Thus, individuals are unlikely to evaluate this new technology similarly to existing vehicle technology. Social influence / social adoption, the process of having one's behavior be affected by others, has been one approach to understanding this evaluation process. This work provides a review and discussion of the incorporation of social influence and social adoption into models of new vehicle purchases. Recent research has attempted to model processes of social adoption of new technology such as information transfer and word-of-mouth. The review begins by describing how recent modeling attempts have fallen into three types: capital vintage models, discrete choice models, and agent-based models. These types explain the level at which social adoption behavior occurs. Additionally, this social adoption behavior fits into three types including: threshold models,

direct-benefit adoption, and preference modification behavior. Then, the state of practice is described using a taxonomy based on a generalized framework with research performed in sociology, social psychology, and social network analysis. The review concludes with the policy implications of these models including the impacts of social network structure, the strength of social influence, and susceptibility to outside influence.

Mann, Bill, Duke Energy

North America's largest Behavioral Energy Efficiency (BEE) Program Keeps getting bigger, better and greener.

Research Area: Program design and implementation Research Sector: Residential efficiency Three keywords that best characterize your work: Personalized Behavioral Efficiency Title: North America's largest Behavioral Energy Efficiency (BEE) program keeps getting bigger, better and greener. In just 6 years, Duke Energy has successfully grown its 15,000-customer Behavioral Energy Efficiency (BEE) pilot into the largest behavioral modification program in the world. Initiated in 2010 and now reaching 2.38 million residential customers in NC, SC, IN, OH and KY, Duke has proven that BEE programs are most successful when the needs of the customer are put above all else, and those customers are provided multiple paths to engage. This session will discuss the design and implementation of Duke's BEE program including its flagship MyHER Home Energy Report, the inclusion of multi-family customers, an interactive web portal and proactive High Bill Alerts (HBAs). You will also learn about the inventive marketing strategies Duke applied to promote their BEE program, including personalized URLs (PURLs) and a sweepstakes that increased enrollment by 400%. To date, Duke Energy's BEE program has saved its customers more than 1 terawatt hour of energy – enough to power more than 1 million homes for a year. Seven out of ten customers indicate high satisfaction (a rating of 8,9 or 10 on a 10 point scale) with MyHER. Duke representatives will also expand on these results by sharing more details of their successes, along with their ongoing plans to improve customer relationships and facilitate more change. They will also discuss how personalization is at the heart of all of their work, and how Duke believes it's the key to conserving energy, lowering its carbon footprint and satisfying customers.

Maoz, Karen, DNV GL

Who are the Contractors that Serve Small Businesses?

The types of contractors that serve small and medium-sized businesses (SMBs) are small businesses themselves, and engaging them requires vastly different strategies than those required for contractors that serve other business types. In recent years, there has been an enormous focus on how to influence the SMB market. To do this, our experience has shown that that there is a strong need to begin with the SMB contractors. This paper/presentation will focus on those hard-to-reach contractors who serve SMBs. The behavior and company structure of these service providers are unique to the energy efficiency market, and the engagement strategy clearly must be tailored to work with these contractors, balancing their needs, the SMBs' needs, as well as the energy efficiency program needs. This paper will describe different programmatic approaches for SMB program models and the benefits and challenges of each with respect to the market actors. The contractor-driven program model, which specifically targets fully utilizing these market actors to ultimately drive toward market transformation, requires the contractor to modify its behavior. We will highlight successful programmatic approaches, as well as three contractor case studies from different parts of the country, including contractors who started in the energy efficiency field and contractors who switched from maintenance to EE/lighting.

Markowitz, Paul, Vermont Energy Investment Corp

Partnering with Non-Profit Organizations to Reduce Low-Income Energy Costs

The Vermont Community Energy Partnership is partnership between Efficiency Vermont and non-profit organizations to help low-income Vermonters reduce their energy bills. This program is predicated on the belief that one of the most effective ways to reach low-income individuals is through non-profit organizations who are already providing these individuals with some type of essential service, connection, or assistance. Vermont is fortunate to have a wide range of organizations, institutions, and agencies that serve low-income individuals, including seniors, people with disabilities, immigrants, people who are housing- or food-insecure, and mobile home owners, among others. Many of these organizations have on-going and direct relationships with their constituents wherein staff or volunteers make home visits that present to provide a service. These home visits present an ideal opportunity to share information and provide assistance around energy efficiency. Under the Vermont Community Energy Partnership, non-profit organizations that have on-going relationships with low-income Vermonters conduct home energy visits. These home energy visits involve the direct installation of energy efficient products, identification of energy-saving opportunities, (such as replacing inefficient refrigerators and weatherization), and raising energy awareness. In the first year of the program, Efficiency Vermont worked with four non-profit organizations and is working with six grantees in the second year of the program. Grantees have included councils on aging, housing and community land trusts, community action agencies, and a non-profit energy cooperative. 225 homes were reached in the first year of the program resulting in over 200 MWH of savings

Marrin, Kelly, Applied Energy Group

Lifting the Lid on "Lift" – The Importance of Overlapping Savings

Behavioral programs often encourage participants to install energy efficient measures that may be part of rebate or upstream utility programs. Why is this "lift" in other program participation such a big deal? It's a great thing, right? It is, but while the lift is a positive outcome of the behavioral program, it is important to appropriately account for the additional savings to avoid reporting the same savings more than once. Because most behavioral programs are evaluated using some type of billing analysis, the savings from an EE measure associated with another program will be included in the behavioral program savings estimates, as well as being counted through the other EE program. While most jurisdictions have acknowledged this issue, accounting for the savings is rarely straightforward. In this paper, we will discuss how overlapping savings happen, clarify why it is important, and describe analytical methods to appropriately account for the joint savings. We'll cover unique challenges and different analytical methods, since what works for a randomized control trial won't work for a variation in adoption approach. We'll share lessons learned from our work evaluating behavioral programs in several jurisdictions, and also address the challenge of determining what program should get credit for the savings, which depends on timing as well as other considerations. This topic will be of interest to evaluators who have to deal with this challenge directly, but also to program managers and program designers, who should consider this issue through all phases of the program lifecycle.

Max, Dana, Navigant Consulting Inc.

Customer Behavior and Engagement in Smart Grid Pilot

Dana Max, Consultant, Navigant Consulting, Inc. Ken Seiden, Managing Director, Navigant Consulting, Inc. Beth Delahaij, Lead Analyst, National Grid Nick Corsetti, Senior Program Manager, National Grid Customer Behavior and Engagement in Smart Grid Pilot This presentation will discuss methodology and findings associated with the primary research con-ducted for the evaluation of customer engagement in National Grid's Smart Energy Solutions (SES) Pilot. SES is an opt-out smart grid program with Time of Use rates and Peak Time Rebates during Peak Event hours. All participants have access to the web portal and some participants have opted into technology packages which include in-home displays, programmable controllable thermostats and smart plugs. Throughout the summer, as well as at the end of the summer, customers partici-pated in surveys gauging customer experience with the pilot. Key findings included: i) Customers took more actions as the summer progressed to reduce electricity usage during Peak Event hours ii) As the summer progressed, customers with installed smart thermostats became more aware of temperature changes in their homes during Peak Event hours iii) High residential retention rates for the opt out program; and iv) Drivers of customer satisfaction With over 11,000 customers enrolled, SES is one of the Northeast's most comprehensive smart grid pilots. National Grid sought customer feedback throughout the pilot through various channels includ-ing a physical Sustainability Hub, low income focus groups, commercial customer interviews and the surveys used for this presentation. They used this feedback to improve program execution on an ongoing basis. Findings, key details and insights on customer response to SES will be outlined in an engaging presentation.

Mclean Salls, Amy, UIL

Water and Energy--Meet Sustainability

Weaving energy efficiency into sustainability for businesses for a one-two punch that can't be beat. The Business Sustainability Challenge (BSC) is an innovative Energize Connecticut initiative. The two large utility companies in CT, United Illuminating and Eversource administer the Energize CT ratepayer funded programs. The BSC connects businesses with the resources they need to get on the path toward sustainability. It helps each business develop a strategic carbon and energy management plan as a foundational step and encourages them to participate in roundtable discussions with their peers. Each BSC business participates in peer roundtable events; we offer four separate targeted customer segments including wastewater facilities, manufacturing, nursing homes, and colleges and universities. Through the roundtables, businesses share ideas and develop collaborations that help them tackle trickier issues like renewable energy and cost-effective recycling and material recovery. Last year a water utility and a family owned manufacturer joined the BSC and charted a course for action that caught the attention of the management in each location. A waste and recycling analysis in one facility and energy kaizen treasure hunt at the other facility yielded surprising and exciting results. Presently both are developing strategic energy management plans. The BSC is about building a culture of broader and deeper energy efficiency and climate emissions reductions through businesses competitiveness and cooperation. When CT businesses take advantage of the BSC alongside tactical energy efficiency offerings including energy audits and behavior change, they create effective strategic energy management plans that do not sit on a shelf.

McRae, Marjorie, Research Into Action

Changing Market Behaviors by Accelerating Commercialization

The 17 DOE national laboratories are home to world-class scientists and engineers and house unique, advanced instruments; the labs have originated a number of inventions that have significantly improved human lives. However,

promising innovations at the lab bench cannot effectively address energy challenges unless and until they are successfully transferred to the marketplace. DOE's EERE Office is piloting Lab-Corps, a training for lab researchers to increase the likelihood of market uptake of their innovations and to accelerate the technology transition process. As of this writing, the pilot has trained one cohort of 14 technology teams from 8 labs and initial evaluation findings suggest pilot effectiveness. This presentation will describe the Lab-Corps approach and early successes. The training approach follows that of Lean LaunchPad, a method that places customer discovery interviews at the heart of the technology development process. For the first time, lab researchers "hit the streets" to understand their target customers' needs, constraints, and alternatives. Their experiences transformed their approach to applied research in general, according to surveyed teams, as well as led them to reposition and refine their technologies under development to better meet market needs. Lab technology transfer managers similarly describe the training experience as highly influencing their approach to their work. Participants believe the approach will shorten time-to-market and increase market uptake of lab-developed technologies, and have already begun sharing their lessons learned with their colleagues.

Metcalf, Morgan, Pacific Gas & Electric

Merging Expert Perspectives to Site DC Fast Charging

Electric vehicle (EV) adoption has surpassed 200,000 units in California. Research in the past has pointed to installing DC Fast Chargers (DCFCs) as one way to further increase and support adoption. DCFCs provide EVs such as the Nissan LEAF the ability to recharge to 80% in 20 minutes. However, DCFCs are expensive to install and little research has been done on how to reduce this barrier. Due to their high power there are often significant upgrades to utility distribution infrastructure that can quickly increase DCFC installation costs. Furthermore, DCFCs can be expensive to operate. Identifying locations where there is available upstream capacity for a DCFC can likely lower the installation cost, but ultimately identifying locations where there is substantial demand can insure that a) the DCFC is highly utilized and b) installation costs are kept low. This project utilized an existing transportation model created by UC Davis to identify 300 locations within PG&E's territory that were along popular transportation corridors and met minimal coverage requirements. These locations were then ranked based upon their modeled driver demand. Each of the 300 locations was modeled to have a 1-mile radius, and specific sites were located within the radius that had available transformer capacity and were publicly accessible. This resulted in over 14,000 locations that can be investigated to host a DCFC. A Best Practices Guide and micro-siting tool were developed for a "boots-on-the-ground" approach – helping installers to identify ideal locations that will meet customer needs and preferences, and minimize other installation costs.

Meyer, Amy, Navigant Consulting

Online Energy Portals for Businesses: How Well Do They Align with the Values and Perspectives of Small and Medium Business Owners?

Online energy portals and energy feedback systems are establishing a track record of energy savings in the residential sector, but their success in the commercial sector (and with small and medium sized businesses in particular) has yet to be confirmed. Such programs are focused on reducing the energy costs of businesses through the use of energy consumption graphics, targeted energy savings recommendations and normative comparisons with similar businesses. Many of these types of programs have been built on the assumption that small and medium sized businesses are often highly motivated to reduce their operating expenses (including energy) in order to stay in business. Historically, however, these types of online programs have struggled to meet their program goals, having difficulty attracting and retaining participants over the long term. In a recent study commissioned by DTE, Navigant sought to gain a better understanding of the values and experiences of SMBs and the degree to which they were aligned with these increasingly popular programs. As part of the effort, Navigant used in-depth interviews to gather information from roughly two dozen program participants. The results reveal a misalignment between the program design and the values and perspectives of small and medium business owners. The presentation will discuss the three main program characteristics of value to small and medium business owners, the misalignment of the program design, and potential approaches to realignment.

Michael, Laura, Booz Allen Hamilton

Change Agents in the Military: The Flash Mob vs. The Choir

Peer-to-peer communication is critical to building support for behavior change campaigns. This session will compare Air Force and Marine Corps change agent programs that were key elements of their award-winning energy behavior change campaigns. The "I Am Air Force Energy" campaign took a "flash mob" approach, quickly creating their Change Champions Initiative for the federal government's Energy Action Month (October). These energy champions served as campaign executors, distributing emails to their units, posting on social media and providing feedback to campaign organizers. Once the campaign ended however, so too did the initiative. The Marine Corps' "Energy Ethos" campaign took a different approach with their Unit Energy Manager (UEM) Program, where one Marine in each unit receives formal training and becomes part of an enduring community over the course of the year serving as a peer leader who disseminates energy-saving information, models behaviors, and engages leadership. This approach is more similar to that of a "choir" that trains or practices in a structured way, collaborates over a long period before executing, and endures after each the individual performance – in this case Energy Action Month – ends. To date, more than 300 UEMs, covering over 90% of Marine Corps

expeditionary units, are officially recognized and providing direct support to the service's energy behavior change campaign. This session will review how the programs were established, evaluate the benefits and limitations of each approach, and provide recommendations for how non-military organizations can determine the best approach for their peer-to-peer program.

Moore, Mitch, Center for Sustainable Energy

Virtual Reality: Can VR be Used to Educate People on Energy Efficiency?

Virtual Reality: Can It Be Used to Educate People on Energy Efficiency? Virtual reality is exploding as a cool new tool to engage people at experiential events, but can this exciting new technology be used to help motivate, educate and activate people to be more energy efficient. We will share our findings from our summer of 2016 outreach efforts at malls, fairs and museums on behalf of Energy Upgrade California®. If approved, we could have the VR experience on site for you testing! Energy Upgrade California is a state initiative to help Californians take action to save energy and conserve natural resources, help reduce demand on the electricity grid, and make informed energy management choices at home and at work. It is supported by an alliance of the California Public Utilities Commission, the California Energy Commission, utilities, regional energy networks, local governments, businesses, and nonprofits to help communities meet state and local energy and climate action goals. Funding comes from investor-owned utility customers under the auspices of the California Public Utilities Commission.

Morris, Lucy, Pacific Gas and Electric

Random Assignment + Billing Analysis + Thermostat Data = Reliable Savings Estimates for Smart Thermostats?

Smart thermostats have been the talk in efficiency circles for several years running. Still, uncertainty remains about the energy savings they produce. Recent research suggests single digit whole-home savings—though zero usually remains in the confidence interval. Interpreting this body of research is a challenge due to many factors: the wide variability in study design, sampling bias related to convenience samples (ex: DR-related thermostats) and self-selected participants, and a lack of valid comparison groups. This presentation discusses the results of a large experiment–specifically, a Randomized Encouragement Design–in which over 2,000 smart thermostats were installed in homes and monitored for a year. The study includes multiple brands of smart thermostats installed across several climate zones. The data collected and analyzed for the encouraged group includes household demographics, whole-home gas and electric billing data for the 12 months before, and 12 months during, this project, and thermostat-level data on set point and HVAC run time. Whole-home gas and electric billing data for the same time period was collected for the non-encouraged/control group. In addition to summarizing a number of key operational learnings gleaned from running an experimental design of this magnitude and complexity, this presentation will include the savings results from the billing analysis of the winter months. The results of the billing analysis will be supplemented with insights provided by thermostat data which is expected to yield a more nuanced understanding of how people are interacting with these thermostats, and how this interaction affects efficiency savings.

Newman Salvador, DeAndrea, Renewable Energy Transition Initiative

Smart Phone and Low-Income Housing: A Unique Opportunity for Energy Conservation

Due to a variety of factors, including the subsidization of energy costs, which alleviates immediate financial burden, recent trends have shown a lack of engagement for affordable housing residents to participate in energy conservation. According to a 2014 Rocky Mountain Institute study, "U.S. public housing uses 40% more energy per square foot than privately owned housing." Acknowledging these results provides apt reasoning to target U.S. public housing in realizing and reaping the benefits of the great advances in energy conservation. Excitingly, directed efforts will result in environmental and economic savings. Moreover, a 2015 Pew Research Study found that "10% of Americans own a smartphone but do not have broadband at home, and 15% own a smartphone but say that they have a limited number of options for going online other than their cell phone." This reality has resulted in a large subsection of the American population that is 'smart phone dependent'. This presentation will highlight research that documents the overlap between smart phone dependent persons and low income and affordable housing residents. Smart phones are being leveraged for a variety of activities, from researching health conditions to investigating future employment opportunities. Consequently, with smartphones increasingly inherent within the lives of low-income individuals, this presentation will highlight key ways to integrate energy conservation information into the lineup. Reaching low income and affording housing residents can be tricky due to an information barrier. However, if mobile technologies are used to establish communication, while utilizing gamification and incentives to maintain engagement and retention, future growth and continued improvement in this arena is endless. Behavioral economics would suggest that reaching this underserved demographic will allow for savings while creating more sustainable, energy efficient life styles. In parallel, another benefit is the ability to create data to track and learn which efforts are most effective. To kickstart this important work, RETI is currently developing a mobile application that will be released early fall of 2016; this application will directly target helping low-income citizens and affordable housing residents.

Nicholls, Ashley, KSV

How Smart Utilities Can Master Communication with Millennials and Why They Should

Millennials- the biggest generation of customers ever– yet they fall outside propensity models for many utility programs. The irony is Millennials want a deeper relationship with their utility, according to new research from KSV, they're an underserved audience with tremendous upside. They're hyper-connected and want to be smarter with energy. Key findings reveal: Millennials are the least confident generation when it comes to energy. One third rate their energy knowledge as "below average." Millennials pay more attention to utility communications– and what's missing matters. They're 10% more likely to recall utility communications, yet they are nearly 20% less likely to say they have received useful suggestions on ways to save energy. Millennials value authenticity and transparency in the brands they do business with. Over half say it is important for utility communication to be seen as honest, yet only 24% say the communication they currently receive is honest. Millennials are more likely to visit their utility's digital channels – giving utilities vast potential to learn more about their habits. Eight in 10 Millennials expect their utility to use collected data to tailor messaging and offers to them. For a sneak peak of our interviews with Millennials: https://vimeo.com/143911573 In this session, Ashley Nicholls, director of energy strategy/principal at KSV, will share how utilities can develop an action plan to engage this audience. KSV surveyed 1,575 utility customers across the U.S. and interviewed approximately 200 customers in-person. Founded in 1977, KSV is a marketing firm focused exclusively in energy and sustainability.

Noormohamed, Uzma, Illinois Science and Energy Innovation Foundation

Funding an Innovative Community of Practice in Residential Consumer Engagement

The Illinois Science and Energy Innovation Foundation (ISEIF) has been leading an innovative community of practice, the only one of its kind, focused on consumer energy engagement. Created by the Illinois Electric Infrastructure and Modernization Act (EIMA), which mandated the state's investor-owned utilities to roll out advanced metering infrastructure (AMI), ISEIF has funded over twenty nonprofit organizations since 2013 to engage and educate residential consumers about AMI-enabled products and services, with an emphasis on the low-income and seniors. This portfolio of projects comprises the largest non-utility, AMI consumer engagement effort in the United States. ISEIF's funding has expanded the reach of new programs and technologies, such as real-time pricing, demand response, and energy management devices, into demographically diverse communities. By prioritizing community-based efforts and culturally appropriate messaging, grantees are generating important insights into their energy habits, needs, and preferences that might not be gained through utility-led campaigns. These insights are shared, refined, and iterated by the grantee cohort, and propagated among other leading organizations through external communications efforts. This presentation will demonstrate lessons learned from standout projects, including: a study, conducted by the University of Illinois's Building Research Council, of energy usage patterns across affordable housing complexes in both urban and rural areas; an outreach campaign by Centers for New Horizons targeted towards African American families; and a Chinese New Year poster distribution led by the Chinese-American Service League in Chicago. Additionally, it will highlight findings from the larger effort to develop a community of practice in the field.

Orfanedes, Laura, Fiveworx

Stacking Behavior in Our Favor: A Digital Behavioral Intervention Pilot

Alliant Energy in Wisconsin implemented the first year of a two-year pilot program, called Alliant Energy Advisor. Its objectives were to deliver deeper and broader energy savings through consumer adoption of multiple energy efficiency measures and behaviors, as well as gauge savings from behavioral actions for large-scale rollout. The pilot addressed common consumer barriers and misperceptions about energy, including the fact that most Americans think they use less energy than they do and that their homes are already energy efficient. As a result, they are completing, on average, only one-three energy-saving actions. The utility's customers contribute to a statewide energy efficiency program, yet, were participating at a rate of around two percent. The utility wanted to explore innovative behavior change approaches to reach and engage customers and drive greater program participation. The presenter shares the most important lessons learned from implementing the first year of this award-winning program that used an innovative combination of "stacked" behavioral interventions (commitment, feedback, follow-through, and framing) and psychosocial segmentation, propensity models, pre-defined customer journeys, integrated web apps, and marketing automation to increase customer engagement and change behavior. Third party EM&V showed a 150% increase in program participation in energy efficiency programs among pilot participant, verified kWh and therm savings; significant increases in email engagement; and improved customer satisfaction. In presenting the case study, the presenter will also share a framework of ideas for program administrators and evaluators to consider when developing, evaluating, and continuously improving this type of multi-pronged intervention program design.

Palchak, Elizabeth, University of Vermont

Energy Cultures: Renting in a University Town

The split-incentive problem in rental housing has been widely documented as a complicating factor in energy efficiency goals. This is particularly relevant in university towns like Burlington, Vermont where a large percentage of the population are renters. Both landlords and renters lack incentives to invest in energy efficiency upgrades, making the study of energy conservation behavior particularly relevant with renters. The study of energy cultures in New Zealand has gained momentum in the last five years as a way to understand the various factors associated with how and why people use residential energy. The research on energy cultures combines energy practices, materials (like appliances) and norms to gain a more accurate picture of energy conservation behavior. Much of the literature in the field of social norms and culture change has examined energy consumers as a homogenous group, but the investigation of energy cultures highlights the variability of users in residential housing. This project uses smart meter data and a 42-question survey combined with focus group interviews to develop characterizations of energy consumers in Burlington, Vermont, a small city similar to many other university towns in the United States. This study is part of Vermont's $69 million award in Federal grant funds to support Smart Grid funding. This work is new in its combination of qualitative and quantitative data and may be the first study on energy cultures that includes energy use data.

Parlin, Kathryn, West Hill Energy and Computing, Inc.

The Decision Paradox: Cracking the Barrier Code for Residential Customers

The common purpose of all energy efficiency initiatives is to overcome the barriers and encourage the adoption of efficient installations and practices. However, understanding the barriers faced by potential program participants and designing programs to address the key barriers can be a complex undertaking. Residential customers will not necessarily interpret questions about barriers correctly unless the questions are posed in a way that they can understand and respond to. This type of research requires a deep understanding of both efficient technology and social science concepts. Recent studies have used a variety of strategies to investigate the decision making process, determine motivations for participating and assess barriers for residential customers who receive energy audits. This paper will compare recent efficiency studies, review findings from research into cognitive thinking and consider alternative approaches such as the Analytic Hierarchy Process to glean insights into how to structure survey questions, develop wording and conduct analyses that allow for a more comprehensive and nuanced picture of the decision making process. Some of the topics to be covered are as follows:

- Understanding the value of cognitive interviews and open ended questions to identify the full range of motivations, barriers, influential factors in the decision making process
- Constructing questions that resonate with residential customers and ensure thoughtful and reliable responses
- Addressing issues from multiple angles
- Quantifying the decision making process through pairwise comparisons that can be easily understood and reliably interpreted

This paper will provide the basis for understanding how to improve research into barriers experienced by residential customers.

Parsons, Beth, Tennessee Valley Authority

Change Perceptions, Change Lives: Successfully Reaching Lower-Income Residents

Knoxville Extreme Energy Makeover (KEEM) is a community-based project providing no-cost, comprehensive whole-home energy efficiency upgrades to over 1,250 limited-income homeowners and renters in the city of Knoxville, Tennessee. The project team's efforts to engage city residents have been key to KEEM's success in spreading the word and recruiting participants to the project – but they have required collaboration, imagination and adaptation. Contrary to conventional wisdom, marketing no-cost home energy improvement to limited-income customers is easier said than done. Strategies and messages for drawing residents to KEEM have had to align with local values and goals, and project administrators have had to wrestle with homeowner sentiment that no-cost home improvements are simply "too good to be true." As KEEM wraps up its first year of project implementation, hear from the initiative's leaders on messages and activities they've developed and lessons they've learned from engaging limited-income homeowners in energy efficiency. The KEEM team includes several institutional actors with a long history of implementing energy efficiency programs – the Tennessee Valley Authority's (TVA) EnergyRight® Solutions, Knoxville-Knox County Community Action Committee's (CAC) Housing and Energy Services (the region's Weatherization Assistance Program provider), the City of Knoxville's Office of Sustainability and the Alliance to Save Energy (ASE). Session attendees will take away a better understanding of the touchpoints, strategies, messages, and channels used to effectively generate interest and participation in KEEM.

Patterson, Olivia, Opinion Dynamics

Home Energy Reports: Who is Driving the Savings? Using Multi-level Models Identify High, Medium and Negative Savers

Title: Home Energy Reports – Who is driving the savings? Using Multi-Level Models Identify High, Medium and Negative Savers Research Area: Evaluation, models, metrics, decision analysis and other analytics Sector: Residential efficiency As home energy reports reach more customers, it is critical to understand which customer segments are realizing the greatest energy savings. How can groups of customers with high energy savings be identified? How can we cost-effectively target customers for program expansion? The answers to these questions are invaluable in helping utilities reach beyond the "low-hanging fruit" and continue to expand energy savings as programs mature. Our paper presents the results of a multilevel approach to calculating individual savings estimates for a multi-year home energy savings report program. Multi-

level models allow us to generate individual-level savings estimates that take household and demographic characteristics, as well as traditional controls like weather into account. These individual-level estimates allow us to identify groups of high, low, and negative savers, and to investigate whether participants tend to stay in the same group or move into a higher or lower savings group over time. Our study found that overall savings numbers hide a great deal of variation in program savings at the household level. Specifically, certain customers achieve significantly higher savings than others, some customers (~40% gas and electric) actually experience negative savings, and customers who are negative savers in the first year rarely evolve into positive savers over time. Taken together, these findings suggest that utilities and implementers can increase HER savings by moving away from a one-size-fits-all approach, expanding outreach to customers likely to be high savers, and changing offerings for low and negative savers.

Payne, Christopher, LBNL

Building Sustainability through Institutional Behavior Change

While much of the attention for sustainability has been directed at individual users and consumers, our focus is to look at the roles that organizations and institutions play in creating significant and persistent behavioral change toward sustainability. Specifically, our work on institutional behavior change is to provide evidence-based social-science guidance to organizations as they develop approaches for achieving their energy efficiency, renewable energy, waste reduction, and other sustainability goals. We present a basic model of institutional change that includes "motivation," "ability," and "context" as primary variables. We follow with eight basic principles of organizational change that we have derived from the literature. Next we present our "Roles, Rules, and Tools" framework for implementing these principles. Finally we illustrate this approach by 2-3 case studies drawn from the public and private sector, which show that by applying a combination of technology and behavioral strategies in their institutional context, organizations can achieve measured energy savings as much as 30-50 percent.

Peoples, Nicole, Corporation for Ohio Appalachian Development

One Town at a Time

Weatherize Nelsonville is a partnership between the City of Nelsonville Ohio, the Corporation for Ohio Appalachian Development (COAD) and Hocking Athens Perry Community Action (HAP CAP), to lower residential, community and business building energy use by increasing participation in energy efficiency programs offered by AEP Ohio and Columbia Gas of Ohio. COAD and HAP CAP approached Columbia and AEP to duplicate and expand a similar one-town-at-a-time weatherization initiative that they had successfully conducted with utility cooperation in Murray City, Ohio during 2012. The Weatherize Murray City project won the Alliance to Save Energy's Andromeda award because of its innovative approach to combining several energy efficiency programs to weatherize an entire town. Several Appalachian communities were considered for an expansion of the concept, and Nelsonville was selected because of the wide variety and condition of the buildings within the community, the decades long energy efficiency partnership between the utilities, COAD and HAP CAP, and the project's ability to contribute energy savings to Athens County, Ohio's participation in the Georgetown University Energy Prize competition that is being coordinated by Upgrade Athens County. The point of Weatherize Nelsonville is to engage an entire community in the task of becoming more energy efficient. One year after initiation of the two-year project we have been uniquely successful with rental housing and the faith based community. We have learned much that others of our ilk find of benefit as we strive to care for our common home.

Peterson, Thomas, ISEEB (Institute for Super Energy Efficient Building)

Communitywide Program to Promote Super Energy Efficient Home Retrofitting

ISEEB was specifically formed to address retrofitting our existing high energy use residential housing - - a huge problem needing immediate attention given our climate situation. To specifically help to solve that problem, a comprehensive National/International business model was developed to accelerate the transformation of the home construction industry to a significantly higher level of building envelope/enclosure performance. The plan involves a unique four-pronged community wide approach: • Train existing local constructors (designers, builders, & remodelers) in how to achieve SEE standards - - requiring "at least" a 75% reduction in heating and cooling energy use. • Educate local building & homeowners and governments about the multiple and diverse personal & community economic as well as the comfort and environmental benefits of SEE buildings. • Connect homeowners and SEE builders and offer diverse financing programs for SEE projects with energy savings paying the finance costs. • Provide continuing support to constructors in the cost effective retrofitting of existing homes & buildings. ISEEB promotes optimal low cost & high efficiency SEE buildings that with the addition of renewable energy are net zero buildings. While addressing climate change is paramount, retrofitted SEE homes and buildings also offer significant economic benefits. The development of a major new retrofitting construction industry will expand our economy in multiple ways and create millions of non-exportable U.S. jobs. Those new middle-income jobs combined with energy dollar savings for SEE building & homeowners will definitely improve both local and national economies - - both short-term and long-term.

Pless, Shanti, NREL

Occupant Engaged - A High Performance Building Control Strategy for Engaging Occupants

As was recently highlighted in California's Pathways to ZNE Buildings roadmap, understanding occupant interactions with high performance building controls can lead to further energy savings opportunities. In general, the building controls industry has trended toward more automation for energy savings, resulting in complex systems that have removed occupants from engaging in better controls. In this paper, we propose a solution for a simpler controls philosophy that engages occupants, which can help lead to lower energy use and more satisfied users. This control concept, which we have coined Occupant Engaged, is based on the idea that control systems can be designed and operated to require occupant engagement to take a system from the off to occupied state. And then the system's automation will turn off or go to unoccupied state if the occupant "forgets" to turn off the system. This paper documents specific lighting control, plug load controls, glare controls, and HVAC control implementation successes of the Occupant Engaged controls across NREL's campus. In one case, savings from Occupant Engaged lighting controls in a partially daylit break room saved 70% in lighting energy use as compared to a typical occupancy sensor fully automatic lighting control system. In general, we have found occupants will engage with their systems, and energy savings from these simpler controls are greater than fully automatic controls.

Podolefsky, Molly, Navigant

Softening the Tone--Improving HER Program Satisfaction

Must utilities settle for low program satisfaction in order to achieve savings through Home Energy Report (HER) programs? DTE Energy is investigating this question head on with research into the effects of softening the tone of HER messaging on satisfaction and savings. While HER programs are a positive experience for some customers, encouraging them to conserve and save money on their energy bills, HERs can frustrate inefficient users. Participants who consistently rank poorly in neighbor comparisons may feel that efficiency goals are too difficult to achieve. These customers often report low program satisfaction and may disengage from the program entirely. Between February and December, 2016, approximately 100,000 households with inefficient energy use were assigned to either a "Soft Norm" or "Target Rank" message designed to soften the tone and provide a more positive experience for these customers. Through experimental design, DTE identified the 150,000 most inefficient users in the HER program, assigned 50,000 to each of the alternate messaging regimes, and assigned the remaining 50,000 to a control group who will continue to receive status quo messaging. DTE and Navigant have designed monthly surveys to determine the effect these alternate messaging campaigns have on program satisfaction, and will also analyze the effects on savings. Eight months of study data will have been collected and analyzed to report initial findings at the BECC conference in October, 2016. Significant increases in customer satisfaction and/or savings may provide a path forward to more fully engage the most inefficient users in HER programs.

Reeves, D. Cale, LBJ School of Public Affairs

Information Preferences for Solar PV Adoption: Comparing Two Markets

Residential adoption of solar photovoltaics (PV) is spreading rapidly; federal, state, and local policy initiatives, decreasing hardware costs, and novel financing structures such as third-party ownership (TPO) are helping to make solar PV a financially viable option for more potential adopters, but they are also adding complexity to a decision-making context already fraught with complications. Facing such a complex decision, potential adopters resolve uncertainties by relying on various information channels such as their local utility, neighbors, and mass media. Understanding how preferences for information channels change as adoption spreads within and across markets lends insight into strategies to reduce soft costs – particularly those related to customer acquisition. Using new, individual-level survey data from solar PV adopters in two neighboring northern California markets, in this paper we compare adoptions – the conditions that "spark" them and the information channels that fuel them – across markets at different levels of maturity. Then, by developing a novel theoretically-derived framework relating market maturity to adopter behavior and using event-history techniques, we model changes in the importance of local vs. cosmopolitan information preferences as markets mature. We find that, conditional on their availability, neighborhood peer effects operate similarly across markets and that information from local utilities becomes more valuable as markets mature. We also find that the installed base in more mature markets has the effect of accelerating the early phases of adoption in newer markets, providing empirical evidence that the pattern of adoption within one market is conditional on the pattern of adoption in earlier markets.

Rench McCauley, Dave, U.S. Department of Energy

The Solar Energy Evolution and Diffusion Studies (SEEDS) Program

This talk will discuss the U.S. Department of Energy's SEEDS program. Over the past three years, SEEDS researchers have enhanced our understanding of how incentive structure design can optimize the adoption of solar energy, explored the evolution of technological breakthroughs utilizing big data and text analytics, and advanced the state of behavioral science and agent-based modeling through the development of new tools and techniques. As such, this talk will discuss the major achievements of the first round of SEEDS projects and the exciting new topics and techniques being explored by the latest

round of SEEDS grantees. Examples of work presented in this talk will include studies utilizing advanced agent-based modeling techniques to determine the importance of social pressures on technology adoption choices; the role of social networks and their influence on the decisions of consumers choosing to go solar; and field tests of various Solarize (group PV purchasing) program designs to determine optimal acceleration of solar deployment. The new work discussed is expected to pay special attention to barriers and opportunities for solar technology adoption in low- and moderate-income communities, as well as the unique aspects of institutional and market behaviors in relation to solar energy technology uptake.

Roberts, Cole, Arup

How We Decide: Evaluating Strategies and Trade-Offs

All great civilizations make decisions. Those that succeed make the right ones. Although a significant opportunity for better decision making occurs simply through integrated design and planning, it's not enough. The presenter will draw from well documented research and nearly 20yrs of professional experience to draw key lessons learned in how decisions are made in practice to yield real world buildings. During the course of the presentation, participants will hear how irrational decisions are more common than rational decisions. And what role the default condition plays. From that point of departure, the psychology of choice is examined as it relates to design of buildings. Complexity and lack of time will be placed in context with the pain of losing and the pleasure of winning. Research by leading practitioners such as BJ Fogg and Robert Cialdini will be discussed as well as the perceived and real cost hurdles faced by project decision makers. A four-part management effort will be offered. Finally, the implications of precision and accuracy will be tested against risk, value, and effort. If time allows, some valuable methodologies for making decisions will be presented along with their pros and cons. The presentation may conclude with a reminder that what we have built is perhaps the best guidance for what lasts, and the range in decisions that gave rise to our built environment today. The presentation will draw from the author's work in Chapter 11 of the book Tow Degrees: The Built Environment and Our Changing Climate.

Ross, Zach, Opinion Dynamics

How Wrong Can You Be About What Causes Participant Spillover?

We thought we knew which energy efficiency programs would be most likely to produce additional non-program savings (participant spillover), but we were entirely wrong and you probably would be too! We found that participant spillover is not higher for programs with high program touch and high customer investment, as we hypothesized, but is in fact lower for these programs. As part of a statewide spillover study, we completed 1600 interviews of participants from 38 residential energy efficiency programs offered by the four California investor owned utilities. The interviews, together with participant characteristics, provided a lot of information about the features of programs and their participants that result in higher spillover savings. This paper will provide the data on what does and does not produce spillover, measured both in terms of incidence and savings. In addition to analyzing program and participant characteristics, we reviewed open-ended responses about participants' motives for making additional energy upgrades without receiving incentives from the IOUs. Using all of this information, we paint a multi-layered picture of what constitutes fertile ground for spillover actions. The results can help program planners and managers develop and elaborate their program theories and implementation practices to maximize these effects.

Roth, Heather, Opower

Leveraging Smart Meters to Benefit Low-Income Customers

Utilities across the United States have deployed smart meters (also called Advanced Metering Infrastructure, or "AMI") to almost 50% of residential homes, and many more are considering deployments. The goal of smart meters is to provide greater insight into the working of the grid, as well as provide capabilities including advanced outage management, operational cost savings, environmental benefits, and improved customer engagement. But to what degree have the benefits to low-income utility customers been considered as part of the business case for these deployments? How are low-income families and communities able to benefit from this advanced technology? What distinctions exist between the low-income communities and the general population when it comes to expectations and value from AMI deployments? This session explores how smart meter deployments have characterized the benefits to low-income utility customers and uses concrete examples from in-market programs to demonstrate how leveraging smart meter data can empower low-income households to save money on their utility bills. In addition, this session will provide recommendations that utilities, policymakers, and stakeholder organizations alike can use to ensure ongoing and future smart meter deployments and provide benefits to financially vulnerable customers.

Rubado, Dan, Energy Trust of Oregon

Can Smart Thermostats Help Residential Customers Reduce Heating Usage?

In 2013, Energy Trust of Oregon launched a study to test the Nest thermostat as a residential heat pump control, and found robust electric savings and high customer satisfaction. As a follow-up, Energy Trust conducted a smart thermostat pilot in

2014 for homes heated with gas furnaces, to determine if cost effective gas savings could be achieved. The pilot tested two smart thermostats from major manufacturers with similar feature sets, to assess whether significant savings and high customer satisfaction could be achieved by two different products. Both smart thermostats were Wi-Fi enabled, could be remotely controlled, and used occupancy sensing to automatically setback temperatures. Occupancy sensing was thought to be the primary method of savings, but a behavioral component also existed. Participants created their own schedules, changed temperatures and settings, and enabled or disabled features. In addition, to determine if a self-install model could be successful, participants had to purchase, install, and setup the thermostats on their own. In most cases, smart thermostats replaced programmable thermostats. To assess savings, Energy Trust recruited close to 400 homes to participate and compared their change in gas consumption to that of a comparison group. Participants were surveyed about ease of installation and setup, usage, and satisfaction. The evaluation documented the difficulties, lessons learned, participant attitudes and behaviors, and determined whether smart thermostats could be a viable technology. Ultimately, one product was clearly effective while the other was not, making the path forward for smart thermostat incentives more challenging.

Rupper, Kristie, Cadmus

Schools Get Schooled on the Importance of Continuous Energy Improvement

Schools Get Schooled on Continuous Energy Improvement Continuous Energy Improvement (CEI) programs help participants holistically reduce their energy use in buildings and facilities by incorporating both efficient equipment and behaviors and by initiating a cultural change where all building users consider their energy use. By measuring customer satisfaction, the level of CEI adoption, and the influence of incentives, Cadmus is able to assess the likelihood that behavioral activities are continued after program engagement. PPL Electric Utilities offered a CEI program to school districts, providing technical support for schools to develop and implement a strategic energy management plan. During the first year of this two-year program, school districts select one of their schools to implement the CEI strategies. During the second year, the districts roll out CEI to the rest of their schools using tools and tips learned during the first year. Cadmus will present the methodology and findings from surveys with school energy champions. We will share examples of program successes and challenges during both the first and second years, discuss the level of CEI adoption in schools, and examine the influence of program incentives. Other regions can use these findings of activities and program design elements that improve the likelihood of behavior changes to implement or refine their own CEI programs. Key points Importance of incentive on initial and continued program participation Level of CEI adoption and persistence of activities Satisfaction with program

Sadhasivan, Gomathi, DNV GL

Design Learning from the Extremes? Energy Efficiency in Saudi Arabia

Recent reports have stated that Saudis consume three times more electricity than the world average and the per capita consumption is increasing year over year. The kingdom has experienced rapid economic growth over recent years. Since 2000, the energy consumption per capita has increased by more than 30%. Recognizing the growing domestic demand, energy efficiency has been identified as a national priority. Given the arid desert climate, electricity consumption for air-conditioning in Saudi Arabia exceeds 70% of the total electricity consumption during summer months. But how much does user behavior play a part in driving up these consumption numbers? This presentation will showcase findings from extensive research conducted across the Kingdom of Saudi Arabia amongst over 4000 residential customers and will shed light on topics such as: 1) The relationship of dwelling type, ethnicity, and geography with electricity consumption 2) Price sensitivity and willingness to change cooling and heating behavior and variation in willingness by consumption level 3) Penetration of energy efficient lighting and appliances in the household 4) Willingness to pay a premium for energy efficiency 5) Attitudes towards energy and water consumption and conservation This presentation explores energy efficiency in the Kingdom of Saudi Arabia and the potential participation of customers in energy efficiency programs.The audience for this paper is utilities and program designers and implementers who believe that “if we understand what the extremes are, the middle will take care of itself”.

Sanguinetti, Angela, SEE Change Institute

Smart Home Shopping: Insights from Research at Retailers

The burgeoning landscape of smart home technology brings opportunities for home energy management (HEM) through energy efficiency, behavior change, and demand response channels. As part of a comprehensive investigation of the HEM space we partnered with two retailers of smart home products to conduct research exploring customers’ knowledge, perceptions, and adoption of HEM technology. We interviewed customers and retail employees, and conducted passive observations of customers on smart home demonstrations tours. In general, customers were quite unfamiliar with HEM products and struggled to understand how they worked and which products would work for them. Customers that were interested in these products expressed greater interest when they were operating as part of a whole home system rather than independently. However, there was also much confusion around the functionality and value of hubs, despite the technological need many products currently have for hubs to facilitate integration into a wider smart home ecosystem. Customers had varied preferences regarding modes of interfacing with HEMS, including digital, voice, and automation. A

key barrier for some consumers was lack of a smart phone or internet connectivity, which is required for many product-user interactions. Other barriers included a perceived lack of value for the cost, which along with the general lack of awareness of HEM products, implies that a stronger message around value proposition is required to support more widespread adoption in this sector.

Santulli, Michael, SERA- Skumatz Economic Research Associates, Inc

It IS Possible to Conduct Positive, Productive Stakeholder Meetings in Energy, Recycling, and the Environment: Colorado's "Future of Recycling" Project as an Example

Getting stakeholders – (haulers, landfill or MRF owners, recyclers, elected and others in recycling; or implementers, regulators, evaluators, and utilities in energy) to sit in a room and talk beyond the usual entrenched positions on the recycling or energy issues has become a bigger and bigger challenge. To get them to agree on a goal and then work together to determine ways to reach that goal is a rare occurrence. However, that is exactly what this Colorado project did. We will summarize the two key elements that made the meetings productive: a specialized "stakeholder meeting" approach that involved a positive systems-wide approach to group change, and clicker voting used in a way to provide dialog, discussion, and decisions. The authors document how the process was used to get 200varied stakeholders from across Colorado to work together to come up with solutions to attain a shared vision. The authors will briefly summarize the context, methods, and steps for the project, and how others can use this approach toward positive and productive meetings. We will then focus on the results of the recent Colorado State- sponsored work to develop a new statewide recycling plan. The approach provided the project team with a robust, positive, productive set of meetings and the results allowed quantitative assessment of the findings and straightforward development into locally-sensitive State-level programmatic and policy recommendations. No joke – people came out so satisfied that two of the groups wanted to have meetings like this quarterly!

Savage, Troy, Mazzetti

Planning for Energy Efficiency in a Large Healthcare Organization

"come to Sam Directly" For large organizations creating a more energy efficient future involves changing directions and priorities. In the absence of a particular statement/direction from an organization's leader – how can you galvanize leaders around making the changes in thinking and behavior necessary to achieve a positive energy future? In fact, it is even more difficult to make these changes because energy management for a large healthcare organization is a complex system. Complex systems can prove difficult to analyze and study intuitively because in complex systems' cause and effect often do not share a strictly linear relationship and are not necessarily sequential. Yet, our brains are equipped to think in these ways. This means, it is often difficult to gain traction and support for such efforts to change non mission-critical complex systems. Other obstacles abound. Because the effects of sub-optimal energy efficiency are difficult to see within complex systems, and because the complexity of the system can reduce the sense of agency in busy people, rallying sufficient support for change is difficult. Yet some organizations are able to overcome these thinking and behavioral obstacles and plan for a more energy efficient future. From a consultant's vantage point, I explore the path of one such healthcare organization. Through a series of workshops, this organization deeply explored problems and proposed important solutions. More importantly, its members were able to understand their agency in an individual and collective sense, create and operate within systems to increase that agency and together build a platform to meet their energy goals.

Schneider, Claudia, Columbia University

Motivating Sustainable Behavior Through the Anticipation of Positive Future Emotions

The present research explores the relationship between anticipated emotions and sustainable behavior and suggests novel approaches to promoting pro-environmental action through leveraging anticipated (positive) emotions. Across two studies and multiple treatment designs, we find consistent evidence that anticipating one's future emotional state just prior to making an environmental decision can promote a wide variety of sustainable outcomes. Results from Study 1 confirmed that the feeling of experiencing guilt accompanies or follows from making a non-environmentally friendly choice, while the feeling of experiencing pride accompanies or follows from a pro-environmental choice. Building on these results, Study 2 examined the causal effects of anticipated pride versus guilt on sustainable decision making by making anticipated emotions (i.e. pride and guilt) salient just prior to participants making a series of environmental decisions. Results indicate that anticipating pride is more effective than anticipating guilt in promoting pro-environmental action. This core finding challenges current orthodoxy in environmental messaging, which favors inducing negative emotions such as guilt and fear to promote pro-environmental action. Implications for basic theory and intervention design are discussed.

Schultz, Wesley,

Using Environmental and Public Health Messages to Motivate Energy Conservation

Recent research has shown that strategies which prime household decision makers to consider the environmental and health benefits of energy conservation report greater household energy savings compared to conventional economic

messaging (Asensio and Delmas, 2015). Utility- and government-run conservation, energy-efficiency, and renewable (clean energy) programs have historically used economic messages to enroll participants in energy-efficiency program offerings, but this approach has left significant cost-effective efficiency potential unrealized. Also, as Asensio and Delmas (2015) report, the economic frame can backfire and lead households to consume more, not less, energy as the value that household decision makers attach to the convenience and comfort of using more energy may outweigh the relatively small economic benefits of conservation actions. Using intrinsic prime messages (that activate pro-environmental, pro-social, or public health values) rather than extrinsic prime messages (that activate personal status-seeking values) may be more effective at reducing energy consumption. In this presentation, we summarize the intrinsic prime literature, including the provocative work by Common Cause researchers (Chilton, Crompton, Kasser, Maio, and Nolan, 2012), and present the results from an applied field experiment conducted during the summer of 2015. The study used normative feedback coupled with environmental and public health messages to reduce window air-conditioning use among low- to moderate-income tenants of a large multi-family building in downstate New York who do not pay their own utilities. The normative feedback strategy and the normative feedback combined with intrinsic priming strategy both resulted in significantly reduced electricity consumption compared to the control condition. The weekly savings ranged from 1% to 8%, and the monthly savings ranged from 3% to 5%. The reduced levels of consumption persisted for two months. Few behavioral studies have demonstrated such stable and lasting effects from behavior-change in the energy domain. A longer-term impact evaluation is anticipated. Marsha L. Walton, Kaitlin Phelps, Jennifer Tabanico, P. Wesley Schultz, Renee Bator

Schwartz, Daniel, University of Chile

Contingent and Non-contingent Incentives on Recycling Behavior

Previous evidence has shown that using monetary incentives to promote social behavior is challenging. In two field experiments, we examine different cash-transfer delivery mechanisms to incentivize recycling in a neighborhood with almost no door-to-door collection. In study 1, households (N=951) received an invitation letter to recycle in a nearby drop-off center. Letters indicated a “recycling day,” and that those attending would receive a contingent cash reward. We randomly varied the size of the reward (low, medium or high) and whether there was a donation option (“if you prefer, you can donate this money to an environmental cause”). In study 2, participants (N=403) were recruited in public places to participate in a recycling program. Those who accepted were randomly assigned to different reward sizes (low or medium) and reward type (contingent or non-contingent on attending the “recycling day”). In the non-contingent condition, participants received the cash reward with the invitation letter. In both studies recruitment was conducted 7-12 days before the “recycling day.” We found that households were more likely to recycle and recycled more (in lbs.) when contingent rewards were larger (both studies), but only when there was no donation option. With a “donation option,” households were less likely to recycle as the reward increased. Households in the non-contingent-reward group were also more likely to recycle when rewards were larger, and any non-contingent amount was more effective (likelihood of recycling) than a low-contingent reward. On average, households in the non-contingent condition recycled more (in lbs.) compared to any contingent amount.

Sellers, Brittany, City of Orlando

Shaping Sustainable Energy Practices in the City of Orlando

The City of Orlando has embarked on a plan to reduce 90% of our total greenhouse gas (GHG) emissions by 2040. Since the majority of the majority of these emissions originate from energy use across the building sector, it has been critical for the city to prioritize our efforts in this area. Specifically, we have focused on the largest 6% of our building stock, which contribute to more than half of energy use and air pollution in Orlando and provide the opportunity for large-scale improvements in energy performance that will yield significant, rapid results in order to reach our energy and climate action goals. However, in order to develop a locally tailored suite of policies and programs that will have the largest impact on these changes, achieve significant energy savings, boost the local economy, and best suit the needs of the local community, the city has led an extensive stakeholder engagement and outreach initiative that has proven to be insightful and influential in terms of individual- and organization-wide practices and perspectives. This presentation will focus on the challenges and successes in the development of a local policy as a participant in the City Energy Project, a groundbreaking national initiative aimed at improving energy efficiency across American cities, with an emphasis on the process of engaging and collaborating with local stakeholders and incorporating their feedback and unique viewpoints into the attitude and behavior change components of the policy.

Sergi, Brian, Carnegie Mellon University

Assessing Public Perceptions of Energy Tradeoffs with Discrete Choice Analysis

In this study, we design a discrete choice experiment (DCE) to asses how individuals make tradeoffs between climate, health, and economic consequences when evaluating electricity generation scenarios. In this DCE, individuals choose between different combinations of electricity generation portfolio, monthly electricity bill, and carbon dioxide (CO2) and sulfur dioxide (SO2) emissions levels. We administer this DCE to U.S. residents recruited through Amazon’s Mechanical Turk (N=1006), and randomly assign participants to different conditions that include or omit CO2 and SO2 information as well as information on the monetized damages of these emissions. We find that groups with emissions information tend to make

choices consistent with preferences for emissions reductions, and that some—but not all—of respondents' preferences for renewable portfolios derives from perceived emissions reductions. We also find that providing information about reductions of both types of emissions increases respondents' support for most portfolios, and can counterbalance concerns about increased higher electricity bills. We do not, however, find a strong relationship between preference for emissions reductions and the size of monetized emission damages, and we tend observe larger heterogeneity in individuals from a given U.S. state than across them. Finally, we provide checks on the results, finding that most respondents give responses consistent with traditional assumptions of utility theory. Although there are limitations to the interpretation of stated preference studies, our results suggest a public support value in communicating and co-optimizing environmental and health co-benefits of climate mitigation efforts.

Shelton, Suzanne, Shelton Group

Words Matter

We all know the lingo that goes with marketing to consumers about energy and the environment: Green. Eco-friendly. Sustainable. What do Americans really think of these terms? Do consumers understand their meaning? What impact do these words have when it comes to marketing? What words have a positive impact and what words have a negative impact? In this panel session, Suzanne Shelton, President & CEO of Shelton Group will share her firm's research around green buzzwords—whether consumers actually understand the words, if they conjure up positive or negative feelings, and what this means for SEO search terms. Then, Laura Orfanedes, Chief Strategy Officer of Fiveworx, will delve even deeper into the effectiveness of buzzwords and messaging in regards new approaches in email marketing and marketing automation. Laura will review best practices outside and inside the industry to spotlight what does/does not engage consumers digitally, how messaging impacts email open and click-through-rates and more importantly, behavior change programs.

Sherwin, Evan, Carnegie Mellon University

Household Energy Consumption Effects of PG&E's Electrical Efficiency Rebate Program

Do rebate programs for residential energy efficiency lead to lower electricity consumption? To move towards sustainable, low-carbon, and affordable energy systems in the U.S., energy efficiency is likely needed to play a central role. This will require robust, large-scale programs that deliver the intended energy savings. With the roll-out of smart meter programs, utilities and policymakers have unprecedented data to evaluate the effects associated with energy efficiency and demand-side management programs. Using an unbalanced panel of electricity consumption data from smart-meters, from approximately 30,000 households in the service territory of Pacific Gas and Electric from 2008 to 2011, together with demand-side management and energy efficiency program participation information, and weather information, we assess the effect of rebates for household electrical efficiency improvements on actual household electricity consumption. We find that participation in an efficiency rebate program leads to an average increase in household electricity consumption of about 7%. We suspect that this increase is largely because the majority of rebate programs are not contingent on equipment scrappage or recycling. As a result, the rebates are likely behaving as an equipment subsidy, leading to additional household energy services for participants, rather than simply improving efficiency for the household's previous level of energy services. These results reaffirm the importance of continued evaluation of energy efficiency and demand-side programs, and strongly suggest that systematic efforts should be made to pretest these programs to determine whether households behave as expected by program planners.

Shih, Cheng-Hao, Center for Energy and Environmental Policy, University of Delaware

Inter-state Transfer of Energy Efficiency Programs in the U.S.

In the past fifteen years, new state-level energy efficiency administrators such as Efficiency Vermont and similar organizations in Maine, Oregon, New York, Delaware, and Washington DC have emerged to support energy efficiency and renewable energy programs at the state and local level. These new energy administrators play a critical role in coordinating resources, information and networks between the public sector, private sector, and civil society to develop innovative and effective energy programs. This paper will assist policymakers and researchers in understanding the coordinative role and functions of these new energy efficiency administrators, their interactions with other institutions, and their influence during the process of energy program formation and transfer. My paper will provide a new institutional and regulatory perspective on the process of inter-state transfer of energy efficiency programs. Using data describing financial incentive programs for energy efficiency in commercial and residential buildings, I construct an econometric Event History Analysis (EHA) model to analyze the critical internal and external (e.g., political, economic, and social) determinants that influence program adoption and transfer. Preliminary results indicate innovative energy programs are more likely to transfer among states with similar regulatory environment, political context, and fiscal situation. These results provide a foundation for further examination on more specific determinants such as state-level administrative structure, interaction among institutions, and funding sources to study the inter-state transfer of energy efficiency programs. This paper will

present lessons learned that can help state and regional governments create a roadmap for the diffusion of innovative energy efficiency programs.

Skumatz, Lisa, SERA- Skumatz Economic Research Associates, Inc

Retention, TDFs, and EULs in Behavioral Programs: What are the Results and Specific Program Implementation Implications?

Behavioral programs are increasingly popular, and there is intense interest in performance statistics—and particularly lifetimes, for these initiatives. This presentation focuses on the multi-year retention work for the Home Energy Reports Program (HER) conducted in a New England state and covers five variations within the program: • Varied demographics: High and average income households • Varied intervention frequency: monthly vs. quarterly recipients. Lifetimes for measure-based energy efficiency (EE) programs are largely dependent on the equipment's removal or failure. Technical degradation has rarely been studied, and when studied, the effect is not significant; measures largely just fail. Behavioral programs are different. We present two elements of the lifetime for this program –the technical degradation, or the amount the year-over-year savings decrease due to behavioral fall-off – and the lifetime (number of years for which statistically significant savings remain). The combination of the two provides the estimated or effective useful lifetime (EUL) for this behavioral measure. We identify both elements for up to four years after cessation of the program's intervention – and present the results for multiple variations of the program (income and HER frequency). Finally, we put the results into context – and application. We identify measure lifetimes by program group, and use the information to identify the cost-effectiveness of the standard program, as well as a variety of potential "cycling" designs that may improve program cost-effectiveness. We compare with results with findings in other states for the same and similar programs.

Sokoloski, Rebecca, University of Massachusetts Amherst

Changing the Conversation on Energy: How Framing Can Impact Behavior

As many countries around the world move towards creating a more sustainable energy system, the way this change is communicated to the public needs to be considered. We ran a series of studies to investigate the affective and behavioral effects of communicating information about energy generation, specifically focusing on renewable versus nonrenewable sources. In one study, mock electricity generation flyers were created to communicate relevant information to participants in a web-based study. Participants were shown one of four flyers, which reported the percentage of energy in their community generated from renewable sources only, nonrenewable sources only, both sources, or neither (control condition). Compared to the control condition, participants who were shown information on both sources or nonrenewable only reported feeling significantly more negative emotions regarding the information and a higher intention to perform energy saving behaviors. Negative emotions mediated the relationship between behavioral intentions and these two conditions compared to the control. Participants who were shown renewables-only information reported feeling significantly greater positive emotions compared to all three conditions; however, behavioral intentions did not differ from the control. The findings of this study suggest that communicating about our continued reliance on nonrenewable energy generation may increase negative emotions and thereby encourage reductions in energy use. Yet, much rhetoric is heavily focused on renewable energy, which may be unintentionally reducing individuals' intentions to curb electricity use. Further studies will investigate how individuals' attitudes, emotions, and actual behaviors change when presented with future projections of the energy mix.

Sperling, Joshua, New Concepts Incubator, National Renewable Energy Laboratory

Aligning Incentives and Public-Private Actors to Realize Co-Benefits for Smart Urban Mobility

The new Denver International Airport-Downtown Union Station RTD light rail line, which has received nearly $1.5 billion in public and private investment, is projected to open in April 2016, offering a new alternative mode for travellers. This study explores incentives for, as well as enablers and barriers to, traveller adoption (including both business travelers and Denver residents) of this new infrastructure, through integration of ridesharing and light rail services. Results address the feasibility of local businesses and new mobility services implementing travel incentives that aim to increase rider satisfaction while realizing cost savings and promoting sustainable mobility in the Denver area. This study helps answer two key questions: How can companies and cities best incentivize the use of new transit investments, ride-sharing services, and integrated mobility mobile apps?; and what are the potential co-benefits (e.g. energy use, vehicle miles traveled, personal convenience, social)? A randomized case-control study explores different incentives (e.g. information, financial, and cultural capital) provided by companies and randomized groups of their employees travelling for business to use transit and ridesharing services to and from the airport to save and meet sustainability goals. Initial results from this effort and a complementary Denver travel behavior survey provides new information on travel behaviors and preferences that underlie adoption of hybrid use of ridesharing services (e.g. Uber, Lyft, employee shuttles) with light rail. Results inform the future

design of public and private autonomous / connected vehicle fleets in ways that may optimize co-benefits among employers, employees, transit agencies, ridesharing services, authorities, and city residents.

Sprei, Frances, Chalmers University of Technology

How do Two-Car Households Experience a Battery Electric Vehicle?

One way of handling the shorter range of a battery electric vehicles (BEV) is to have another car in the household for the longer trips. While in theory this might be a solution there are still questions on how individual households adapt to the shorter range of one vehicle. In this study we investigate how 25 households in Sweden adapt when one of their conventional cars is replaced by a BEV. GPS measurements of their driving patterns with two conventional vehicles as well as with one conventional vehicles and a BEV are recorded for a period of 3-5 months respectively. The members of the household are also interviewed before and after the trial period. This mixed methods approach allows us to see both the actual as well the perceived adaptation from the households. Another strength of the study is that, while some of the families may have had an interest in BEV, none of the families have actively decided to purchase a BEV, thus better representing an average car buyer rather than an early adopter. All of the trial households appreciated the BEV as a vehicle, mainly for the fun driving experience and the quietness. A number of them found the range (actual range of about 120 km) to be too short. This being said none of the households had to give up any trips, change their travel plans or daily routine. However, even if the actual adaptation need was quite low, the higher price and limited range was still a barrier for most households.

Spurlock, Anna, Lawrence Berkeley National Lab

Go for the Silver? "Gold Standard" RCT vs. Quasi-experimental Methods

Randomized controlled trials (RCTs) are widely viewed as the "gold standard" for evaluating the effectiveness of an intervention. However, because they can be prohibitively expensive and challenging to implement successfully, they are rarely executed in most policy settings. In particular, analysis of the effect of energy pricing has largely been conducted through quasi-experimental methods, most frequently matching on pre-period electricity usage data. Using a rare set of large-scale randomized field evaluations of electricity pricing, we evaluate the estimates obtained from quasi-experimental designs frequently used to evaluate electricity pricing programs against RCT estimates. We demonstrate empirical evidence in favor of four stylized facts that highlight the importance of understanding selection bias and spillover effects in this context. First, regression discontinuity methods tend to overestimate the size of the true average treatment effect. Second, difference-in-difference and propensity score methods tend to underestimate the effect. Third, selection biases in non-experimental research designs tend to be more pronounced in opt-in treatments relative to opt-out treatments. Fourth, the commonly used three-day-in-ten baseline empirical approach tends to overestimate the impact of the intervention, likely as a result of spillover effects.

Starkman, Emma, Foundation Communities

Environmental Education for K-5 Kids in Affordable Multifamily Communities

Foundation Communities, a 3000-unit affordable multifamily portfolio in Austin, has been working to engage residents in conservation behaviors since 2009. The most important of these efforts is our Green and Healthy Kids initiative, an environmental education curriculum designed to reach more than 450 children attending free, year-round after-school and summer programming at learning centers located on-site at the affordable apartment communities where they live. The initiative was conceived after several disappointing years deploying low-impact green living manuals and workshops. It proposes culture change by reaching the large number of K-5 students already gathering at community learning centers every day for most of the year, with the hope they will share their new attitudes and actions with their families. While we have not yet been able to measure this kind of community-level impact or culture change, pre- and post-assessment results have shown a 40% average increase in student green and healthy awareness. Students also report practicing conservation behaviors more frequently after participating in the program. This presentation will cover all facets of the program development, implementation, curriculum content, measurable results to date and measurement limitations. A discussion of results will include pre- and post-assessments, as well as on-site observations and instructor feedback. This program can serve as a replicable model for greening after-school programming in a low-income affordable housing context.

Stewart, Mary, KSV

A Year of Insights from Energy Wire: We've Got a Big arketing Problem!!!

The industry continues to discuss this evolution towards a "customer centric" business model, but what's the point if customers are not aware of your investment to do so? KSV's 2015 and 2016 market research, each surveying 1,500 homeowners nationwide + over 200 qualitative interviews with customers (all on video) inspires Energy Wire (www.energywire.ksvc.com), weekly insight into the customer mindset when it comes to energy. With thousands of industry professionals receiving this blog, 20,000 hits and an average click-through rate of 18%, we'll walk through the hottest topics with the highest engagement rates. Here are a few: • The "Real" Value Proposition on Energy Efficiency

• The #1 thing customers want from their utility is more personalized and relevant communications, but how do you get there? • The Top 4 Customer Demands of 2016 and How They'll Evolve • Two Things that Utilities Need to Know about Millennial Customers • Utilities want to be customer-centric, but what's centric to your customer? In this session, Lauren Bell, Senior Engagement Strategist at KSV and Chief Editor of Energy Wire, will share customer insights from the annual research and corresponding topics. This session is for utility marketers interested in customer-centric marketing. Founded in 1977, KSV is a marketing firm focused exclusively in energy and sustainability.

Sussman, Reuven, American Council for an Energy Efficient Economy

Programs Encouraging Energy Efficiency through Behavior Change: A Review

Over the past decade, a rapidly increasing number of utilities and other program administrators have offered programs to encourage their customers to modify behavior in ways to reduce energy use. The most common type of behavioral programs are home energy reports for residential customers, but many other types of behavioral programs have emerged, including programs targeting commercial and industrial customers. In 2013, ACEEE published a report profiling the types of programs being offered, but at that point only limited program results were available. This paper picks up where that report left off, and focuses specifically on programs with effective evaluations and data on program results, particularly energy savings. Of these programs, we highlight select cases that are particularly successful, as measured by program results. Some of the programs reviewed in this paper involve installation of feedback devices, competitions, games, home energy reports, community initiatives, strategic energy management, education and training. By identifying key factors driving behavior change in successful programs, we make recommendations for replicating such results. In expanding on previous research, we surveyed a combined total of over 280 reports, studies and program evaluations obtained through database searches and personal communications, as well as over 60 personal communications with program administrators and other experts. This program review also provides insights into how lessons from behavioral programs can be applied across the full spectrum of customer energy efficiency programs to improve results and increase savings impacts.

Teja, Anu, Northwest Energy Efficiency Alliance

Transforming the Northwest Residential New Construction Market

The Northwest Energy Efficiency Alliance (NEEA) provides support to the Residential New Construction industry to increase energy savings for the region and influence state energy code adoption. This presentation will focus on how NEEA influenced and changed builder behavior throughout the Northwest (ID, MT, OR & WA) over the last 10 years and how evaluation has played a role in shaping program strategies. NEEA identifies key barriers to Northwest builder adoption of energy efficient practice and technologies, and removes those barriers through targeted intervention strategies and increasing value proposition. By offering technical training and assistance, NEEA reduces the learning curve for builders to branch out of their traditional building process and become proficient in advanced building systems. In addition to technical resources and support provided to builders, NEEA also increases the awareness and benefits of energy efficiency to consumers. Increased consumer demand is a primary motivator for builders to take action. Targeting both ends of the supply and demand chain leads to lasting change in builder behavior and allows the voluntary adoption of energy efficient homebuilding practices to pave the way for code progressions throughout the Northwest. NEEA monitors progress and market change through third party evaluations that identify the impact of the intervention strategies and where efforts should be focused. This relationship between evaluation and program design/implementation is embedded in NEEA's program lifecycles and enable the ability to shift resources and strategies as needed to create an effective and lasting impact in the market. Keywords: 1. Market Transformation 2. Evaluation 3. Market Strategies

Thompson, Shauna,

Inspiring Organizational Change through Grassroots Green Initiatives

This presentation will be a lighting talk based on an unintentional case study in driving organizational sustainable practices through a grassroots approach. In 2008, the first Green Team of a large international education organization was created in Washington DC. The team had 10 members who were all passionate environmentalists within an organization of over 200 programs focused on global education and cultural exchange. After an exciting first meeting the team set about making sustainable changes in each department in the DC office. A month later the team had failed to change any of the current policies and procedures due to lack of support from management. The day of this meeting a team member posed a vital question. Three months later the Green Team was recognized by the office of the President and VP in New York, had won an annual event budget from the President's office and was approached by operations management with their own ideas to integrate green practices into office procedures. The Green Team was requested by the President's office to integrate and share best practices throughout the entire global organization, host joint company-wide Earth Day celebrations with partner organizations and regularly report Green Team Sustainability Campaign results at company meetings. In my presentation I will detail the question I asked that changed organization behavior at level beyond what we could have imagined and the steps we took as a team to inspire this change on such a global level.

Todd, Annika, Lawrence Berkeley Nat'l Lab

One of These Households is not Like the Others – Can We Tell Which One?

We often focus on averages - average electricity consumption, average reduction in Demand Response (DR) programs, average enrollment rates. Our research highlights major opportunities for EE/DR programs to recognize and exploit the diversity of households. Using machine learning and econometric techniques on a unique dataset of 100,000 households randomized onto time-of-use and critical peak pricing DR programs, we identify household differences and determine which differences matter most for program outcomes. We discuss ways to increase program success by capitalizing on these insights. Results: (1) personalized messaging and tailored programs can increase program enrollment and impacts. We show that households with high baseloads and high peak usage are least likely to enroll, even though they gain the most and provide the biggest reduction when they do enroll. Personalizing recruitment for this segment may significantly improve outcomes. (2) Understanding differences in appliance behavior can improve usage models. Using surveys and cooling load models, we found that AC ownership doesn't necessarily lead to AC usage. (3) Understanding differences in past energy behaviors can help predict future usage and improve forecasting techniques. We analyze how a variety of household types respond to DR programs, and create a predictive energy use model. (4) Targeting the highest-saving households can improve cost-effectiveness in a world with limited recruitment budgets. We show that targeting households with a high baseload (not just high peak) would increase cost-effectiveness. (5) We highlight the advantages of our segmentation methods relative to traditional methods.

Troschinetz, Alexis, Clean Energy Resource Teams, University of Minnesota Extension

Promise and Pitfalls of Rural Small Business Energy Efficiency Campaigns

Clean Energy Resource Teams (CERTs) helps Minnesotans take action on energy efficiency and renewable energy by leveraging behavior change science to develop action campaigns, among other programming. Past action campaigns have varied from bulk-buy programs, to friendly competitions, to information-for-action campaigns. CERTs, a statewide partnership comprised of a university, nonprofit, state agency, and economic development group, brings diverse perspectives to the application of behavior change. Two recent campaigns, Gobbling Up Savings: LED lighting in turkey barns and Light Up Your Station and Save: LED lighting for independent gas stations, will highlight lessons learned around increasing adoption of energy efficient lighting with these underserved sectors. Specifically, these campaigns will showcase the role of authentic partnerships in program development, implementation, and evaluation. CERTs relied on long-standing partners for sector identification and campaign design. New partners were engaged to effectively deploy relevant behavior change strategies and assess campaign impacts. These campaigns also demonstrate the importance of knowing which existing delivery channels will make for the most effective campaign outreach partners, thereby ensuring overall program success. CERTs experience with right-fit and wrong-fit outreach partners will be shared. Through new and enhanced partnerships with a variety of public funders, campaign participants were guided through funding sources beyond traditional utility rebates to further incentivize and spur action. These two campaigns engaged hundreds of rural small business owners on the topic of energy efficiency and resulted in lighting retrofits for 25 turkey barns and 20 gas stations, jointly saving more than 1.2 million kWh and $115,000 annually.

Turnure, Jim, U.S. Energy Information Administration

Innovations in Energy Efficiency Modeling at the National and Regional Scale

Innovations in Energy Efficiency Modeling at the National and Regional Scale The U.S. Energy Information Administration (EIA) has been engaged in national-scale computer simulation modeling of energy efficiency program investment and electricity demand impacts. Novel modeling approaches developed for analysis of the Clean Power Plan have now been implemented and are part of the National Energy Modeling System (NEMS). By associating regionalized energy efficiency investment with specific sets of end-use equipment rebates, the new NEMS modeling is able to examine new policy issues such as state Energy Efficiency Resource Standards (EERS), the use of energy efficiency for Clean Air Act compliance, and alternative specifications of regional energy efficiency programs. This BECC presentation offers unique modeling descriptions and scenario results and allows for discussion of the role of behavioral programs in enhancing regional energy efficiency program efforts. Specifically, how much more investment may be required to attain certain goals, and what difference would it make if program investments were more effective, and/or more cost-effective due to behavioral elements? The presentation will also address the relative importance of various end uses in different regions of the United States, their growth trends, and the implications of these 'facts on the ground' for targeting both behavioral and other components of energy efficiency program portfolios. Changes in EIA's energy consumption surveys and new EIA data and analysis products will be briefly introduced.

Vogler, Ursula, Metropolitan Transportation Commission

Evaluating SRTS Program Impacts on CO2 Emissions

In 2009-2012, the San Francisco Bay Area's Metropolitan Transportation Commission (MTC) funded Safe Routes to School (SRTS) projects in the nine Bay Area counties as a way of reducing greenhouse gas (GHG) emissions. Five years of hand tally and parent survey data were collected, representing over 330 schools, to evaluate the effectiveness of SRTS programs. The analysis considered the most effective use of regional funding in support of SRTS programs through the proportion of schools involved in SRTS in each county, number of activities at each school, cost per school, and number of underserved schools participating. The evaluation showed strong support that SRTS programs increase walking and biking and decrease miles driven. Overall, evaluated schools showed a 10.7% reduction in greenhouse gas emissions, with evaluation data yielding strong correlations between increased active transportation modes and school participation in frequent walk & roll activities, walking school buses, and bike trains. In addition, schools participating in SRTS for the first time, experienced greater mode shift in the first two years of participation than schools with existing SRTS programs. This presentation will discuss the large scale data collection process beyond hand tallies and parent surveys, identifying efficiencies for data collection. The presentation will also highlight the lessons learned in the San Francisco Bay Area, in terms of specific evaluation results and program delivery. High-quality infographics will encourage practitioners to think about how to share their evaluation results with their communities and build support for SRTS programs.

Vohr, Jill, U.S. Environmental Protection Agendy

Coordinating on National ENERGY STAR® Promotions to Improve Regional Success

In order to help increase the adoption of ENERGY STAR certified products, EPA has created national product promotions that partners across the country can implement in their own markets. By working together with ENERGY STAR, energy efficiency program sponsors can tap into the value of the ENERGY STAR brand, take part in a national call to action, and benefit from the reach of retail and manufacturer partners, as well as EPA's own outreach activities. For example, EPA's Flip Your Fridge promotion included pre-approved retail templates that program sponsors could customize with their local rebate information. Other media opportunities, such as partner appearances on The Ellen DeGeneres Show helped generate national momentum for the effort. Now that more and more consumers are getting their information online and through social media, EPA has also incorporated digital media as a key component of its resources – graphics, videos, web pages, and other content – that can be easily integrated into a partner's outreach efforts. Consumers see the same message reinforced at retail, through earned media, online, and in social media, resulting in more engagement and ultimately increased behavior change. In the case of Flip Your Fridge, one partner reported increased call volume for refrigerator recycling and an increase in the number of refrigerators picked up for recycling over the previous year. This session will help attendees understand the role EPA plays in facilitating these relationships and how partners can leverage the ENERGY STAR brand and promotional resources to amplify the reach of their own programs.

Wang, Jennifer, Stanford University

Exploring Psychological Dimensions of Wasteful Behavior

Previous research has shown that people exhibit a natural aversion to waste that can be a powerful yet underexplored driver of behavioral change. While we know that avoidance of wastefulness can drive behavioral outcomes (by way of sunk costs, outcome bias, social norms, etc.), neither economics nor psychological literature provides a well-accepted definition of waste (McCormick, 1986; Arkes & Hutzel, 1997). Even less has been done to advance theory elucidating how people think about waste and implications for behavior. In this presentation we will share results from a series of studies exploring mental models associated with waste-related behavior. In particular, we will share findings regarding the types of actions perceived as "wasteful", and the criteria that people use to classify such behavior. We test our findings against maxims suggested by Arkes (1996) and by classic utility theory, and investigate the underlying mental models that lead people to perceive waste differently in different domains (e.g. natural resources vs. time). Finally, we hypothesize that mental models and intentions related to waste inform subsequent behavior (Theory of Planned Behavior). We explore future research directions that will allow us to apply an understanding of the perceptions of "waste" to alter wasteful behavior at the individual level. For example, research showing that people perceive waste reduction differently from how they perceive recycling suggests potential value of differentiated interventions. This presentation will describe psychological dimensions related to perceptions of "wasteful" behavior, and highlight how those insights may be used to drive behavior change.

Weaver, Anne, Portland State University

Social Acceptance of Community Solar Gardens: A Portland Case Study

Key words: Solar, Community, Consumer perceptions Accelerating the adoption of renewable energy technologies is at the forefront of the climate change mitigation movement. Many of the state and city climate action plans throughout the United States call for substantial reductions in carbon emissions by 2050. Transitioning into a decarbonized electricity market by both the commercial and residential sectors is a strategy that could help achieve these rigorous objectives. Portland, a city that has been a pioneer for combatting climate change, plans to reduce local emissions by 80 percent by 2050. One of the ways in which they hope to do this is promote the development of community solar gardens. Understanding consumer perceptions of community solar will help predict the diffusion and adoption rates of upcoming neighborhood projects. Because social acceptance is commonly a constraining factor in renewable energy adoption,

examining the perceptions and general support of community solar will be helpful in its diffusion process. A survey of Portland electricity users will illustrate the overall attitudes towards community solar development. Framing community solar in different lenses in the survey will showcase which attributes are most important to different communities. The information gathered from the different framing techniques will be beneficial to planners, marketers, and environmental managers when they face the task of communicating the value of adopting community solar as a viable electricity option. A second component of this project aims to examine the institutional barriers of community solar development, which will be completed through key informant interviews.

Williams, Brett, Center for Sustainable Energy

Characterizing California Electric Vehicle Consumers Segments

Characterizing market segments is increasingly important as the market for electric vehicles (EVs) transitions from enthusiast early adopters into more mainstream consumers and becomes increasingly diverse. Understanding and leveraging this emerging diversity will be key to future EV market expansion. This inquiry uses responses to a survey of California EV rebate recipients collected from October 2013 through June 2015 to provide information about the qualities and characteristics of various subsets of respondents. Survey data explored include demographic characteristics, household characteristics, adopted vehicle characteristics, purchase motivations, and decision-making processes. A particular focus is paid to consumer segments with low initial interest in an EV and who are highly influenced by the rebate (treating markets for all-battery and plug-in-hybrid EVs separately). The findings can be used to more strategically target potential EV consumers with information, marketing, and supportive resources based on segment-specific considerations.

Wolfe, Amy K., Oak Ridge National Laboratory

Moving from insights to interventions: Saving Fuel, Changing Culture

Take known behaviors that waste large quantities of fuel. Add the importance of that fuel to achieve mission goals; empirical literature; newly collected observational and interview data intended to understand why groups of people behave in apparently energy-wasting ways; and sophisticated, granular models that identify how much fuel could be saved through different behaviors. Even with all of the above, it is challenging to design experimental interventions to shift behavior and reduce fuel use in ways that are both effective and quantitatively measureable in short- or longer-term horizons. This paper delineates how a large, multi-institutional, interdisciplinary team addressed this challenge in the Behavioral Energy Operations Demonstration (BEyOnD) program. BEyOnD seeks to reduce ground-based operational fuel consumption by 10% through behavioral change by targeting known areas of waste such as inefficient use of generators, vehicle idling, vehicle operations, environmental controls, and electronics usage. The approach differs significantly from other behavior experiments because it assumes that institutional context has to be understood before successful interventions can be implemented. This paper outlines the problem(s); summarizes literature-based insights and analyses of observational and interview data collected by the BEyOnD team during varied operational training exercises; and describes how the team identified and selected specific behavioral interventions to be tested. BEyOnD focuses on saving fuel among expeditionary forces so that fuel can be used for higher-value purposes. Thus, the program seeks to affect organizational culture—an enduring shift in what constitutes “normal” practices—in a context marked by strict hierarchy, personnel turnover and continuous change.

Wolske, Kim, University of Michigan

What Drives Interest in Rooftop Solar? Insights from the Field and Theory

Household adoption of solar photovoltaics has great potential to reduce greenhouse gas emissions. Market penetration rates in the U.S., however, remain relatively low. This study investigates the psychological and social determinants of interest in residential solar with the aim of identifying potential levers for intervention. Drawing on survey data from 1,156 non-adopter homeowners in four states (AZ, CA, NJ, and NY), we test three common theories of decision-making: value-belief-norm model, the theory of planned behavior, and diffusion of innovations theory. We find support for each theory, suggesting that consumers are seeing solar panels in multiple ways: as an environmental benefit, a consumer good, and as an innovative technology. We then propose an integrated framework that combines all three theories. The results shed light on “who” is most likely to consider solar, “why” they might pursue it, and “what” policymakers and the solar industry can do to facilitate adoption. Notably, the results point to the importance of providing trustworthy information about the financial costs and benefits of solar and of leveraging trusted solar networks to provide such information. Although tested with solar photovoltaics, the proposed framework may have implications for understanding interest in other eco-innovations such as alternative fuel vehicles and other forms of renewable energy.

Worley, Heather, World Bank

Assessing the Effectiveness of EE Campaigns in India

A World Bank-financed initiative to “Scale up Demand-Side Energy Efficiency in South Asia” recently took stock of lessons learned in energy efficiency (EE) to deepen the understanding of the demand-side EE landscape in South Asia and to

develop a comprehensive diagnostic-based set of delivery models, implementation solutions, and entry points for scaling up investment in EE and demand side management (DSM). Part of this initiative looked closely at recently implemented EE communication campaigns in India in order to better understand the effectiveness of EE awareness raising and behavior change efforts. The methodology included in-depth interviews with decision makers and EE agency officials, a survey of consumers, taking an inventory of prior campaigns on EE in energy consuming sectors (industrial, transport, commercial and residential) and their impacts, as well as a stakeholder analysis of key players in EE implementation (including policy, business and consumer angles). This first-of-a-kind analysis in India is providing a better understanding of the public's and decision makers' attitudes about EE campaigns, what is effective and what is not, and how to improve messaging and coordination on behavior change and communication efforts to complement the ambitious program of EE market transformation in India. This work demonstrates that the goal of increasing EE is supported by well-planned, professionally-executed public communication and outreach programs. By looking closely at the effectiveness and challenges of previous EE campaigns and drawing upon lessons learned, we present some insights and provide recommendations for incorporating in future EE awareness, outreach and campaign initiatives in India.

Yu, Min, BC Hydro

Novel Analytical Method for Evaluating Commercial Retro-commissioning Net Impacts

BC Hydro's commercial retro-commissioning began in 2009 to help commercial building owners and operators implement and maintain improvements to their energy management practices. The focus of the program was operational conservation measures, such as improvements to the performance of the building's heating, ventilation, and air conditioning (HVAC) systems, as well as lighting and refrigeration systems. The program operated in parallel with a separate energy efficiency retrofit program. Producing reliable empirical estimates of savings attributable to retro-commissioning program has been challenging. Traditional measurement and verification methods, using monthly energy data and verification of measure installations have proved impractical to measure operational savings due to both to their expense and to the onerous reporting requirements they impose on participating customers. In response to this challenge BC Hydro developed a novel analytical model that made use of Quasi-Experimental Design and statistical modeling with high frequency energy interval data, to produce a reliable empirical estimate of energy savings attributable to the retro-commissioning program at 400+ participant buildings. The model was also able to estimate the synergistic effects of combining a retro-commissioning program with a retrofit program, and holds promise for estimating peak demand savings. The model is flexible and scalable to other commercial retro commissioning programs where high frequency energy interval data is available. The model demonstrates some of the promised improvements in analytics expected to results from implementation of smart metering and infrastructure initiatives.

Zerrenner, Kate, Environmental Defense Fund

What Can Water Teach Electricity about Designing Behavioral Efficiency Programs?

In recent years, there has been an increasing emphasis on behavioral energy efficiency programs and technology. We know there is a huge opportunity to cut down on energy use – and resulting pollution from power plants – by changing the way we behave, but some efforts have struggled to gain a foothold with the average consumer. However, there have been instances of highly successful behavioral programs in the water sector, especially when the community has greater understanding of local water sources and the importance of conserving. Lessons learned from the water sector, especially about message and messenger efficacy, could potentially improve consumer behavior when it comes to energy use. For example, San Antonio, Texas and Melbourne, Australia used conservation programs aimed at cultivating a deeper understanding of the stresses on limited local water sources, which led to a sustained culture of conservation and significant decreases in average water use in these cities. This presentation will include findings from several behavioral water programs that could be applied to the electric sector, as well as original research on water-related energy use in Texas. Since energy and water are inextricably linked, this new research from Pecan Street, Inc. and EDF could alter the efficiency landscape of both sectors. Could the future of behavioral programs be combined to jointly conserve energy and water, streamlining the process and helping consumers better understand their use of both resources? Three words: Comprehensive, Innovative, Collaborative

Zhao, Zhidan, Qatar Environment and Energy Research Institute

Ontology-based Semantic Modeling for Occupant-Centered Building Energy Performance

In recent years, the need to improve building energy efficiency has drawn a lot of research attention due to the huge potential that the building sector has in reducing energy consumption and associated CO2 emissions. Building occupants, as the main consumers of building energy, have been recognized to play an essential role in building energy efficiency enhancements. Not only the occupants' energy-related behavior, but also their concerns about well-being and indoor comfort level have a substantial impact on the overall building energy consumption. There is a need to find an approach that involves understanding the building occupants' energy use behavior and their values in terms of indoor comfort, health, productivity, energy cost etc., that could improve building energy efficiency while maintaining occupants' satisfaction levels with these values. To serve this research purpose, an ontology-based semantic model was developed to facilitate decision making regarding energy conservation strategies in the occupant-centered building energy efficiency

domain. Ontology is a useful way to declare and organize the specified domain knowledge, which is explicitly defined through machine-understandable semantics. The ontology-based model consist of concepts, relations and axioms. Concepts represent the things in regarding knowledge domain; relations model the interrelationships between the concepts and axioms specify the definitions and constraints of the model. The ontology is coded in Web Ontology Language (OWL) format and serves for knowledge representation and reasoning in the occupant-centered building energy efficiency domain.