
Philip Johnson, University of Hawaii at Manoa

WattDepot: Open Source Software for Energy Data Collection and Analysis

Research on smart energy systems generally requires software infrastructure: mechanisms to collect, store, analyze, and present energy data. Current software infrastructures are expensive, utility-scale, and/or tied to specific devices. To facilitate research on smart energy systems, we have developed an open source software system for enterprise-scale energy data called "WattDepot" (<http://wattdepot.googlecode.com/>). WattDepot has a service-oriented architecture consisting of "sensors", "repositories", and "clients". The extensible set of sensors poll energy meters using protocols like ModBus/TCP and send data such as instantaneous power and cumulative energy to a WattDepot repository instance. A WattDepot repository stores the data from individual meters and supports useful representations, such as the amount of carbon emitted by energy consumption or generation. The repository also supports hierarchical organizations of meter data, enabling several meters from a floor of a building to be aggregated together as a single "source". To make these aggregate source representations useful, WattDepot also supports automatic data interpolation so that a client can retrieve an estimate of the total instantaneous power being consumed by a building at any given point in time regardless of whether actual data for that time exists. WattDepot provides a REST API which makes it easy to extend by external developers, interoperate with other tools and systems, and adapt to new applications. The WattDepot tool ecosystem includes sensors, web applications, and visualizations including heatmaps, gauges, and maps. We will present WattDepot's capabilities, the ways it has been used, and how it can facilitate energy research.

Philip M. Johnson is a Professor of Information and Computer Sciences at the University of Hawaii and Director of the Collaborative Software Development Laboratory. He received B.S. degrees in both Biology and Computer Science from the University of Michigan in 1980, and M.S. and Ph.D. degrees in Computer Science from the University of Massachusetts in 1985 and 1990. His research interests include smart grid information technology, software engineering, computer supported cooperative work, and artificial intelligence. He was a co-founder of hotU, an Internet software services company, and has served as a Director of several technology companies.

Joe Kantenbacher, University of California Berkeley

Connecting the Dots: Interdisciplinarity in Behavioral Research

Research concerning the topic of behavior, energy, and climate change (BECC) is performed by members in a range of academic disciplines. It may be that no single discipline can have a monopoly on insights regarding the behavior-energy-and-climate nexus, and that an interdisciplinary approach is most conducive to the development of a coherent and actionable set of behavioral theories. This study examines the network of academics engaged in BECC research in order to determine the degree to which disciplinary boundaries are being crossed. Using online article databases, co-authorship and journal publication records were analyzed for patterns of connectivity and interdisciplinary scholarship. Results indicate that the network, though increasing in general activity over time, features sparse connectivity between disciplines. Consistent with the structural holes theory of networks, "prominent" members of the network were found to bridge disciplinary divides more frequently than the general population of BECC researchers. Interactions with non-academic networks and the prospects for increased interdisciplinarity in the near term are explored.

Joe Kantenbacher is a PhD student in the Energy and Resources Group at the University of California, Berkeley. His current research is focused on the role of information and networks in shaping energy use and the social significance of energy consumption.

Danielle Kolp, The Cadmus Group, Inc.

Using Smart Grid Data to Assess Behavior Changes after PV Installation

Energy efficiency experts sometimes criticize renewable energy incentive programs for not promoting cost-effective energy efficiency measures first, potentially reducing the size of the PV system and therefore the rebate that the program pays. Several PV incentive programs now require energy efficiency audits, however, the customer is often not required to implement changes in order to receive the PV rebate. This leads to uncertainty of the actual energy savings from these programs. Traditionally it is assumed that the energy savings is equivalent to the output of the PV system, however, energy savings could be less or more than the PV system output if homeowners change their behavior and use more or less electricity. For example, a PV customer may feel justified to lower the temperature on his air conditioner during the summer, thereby decreasing savings. PPL Electric Utilities is in a unique position to investigate this issue. PPL Electric Utilities is offering PV incentives and has an advanced metering infrastructure (AMI) where all customers with PV systems have hourly net generation meters. This provides an opportunity to observe, and potentially quantify, the behavioral effects after a renewable energy installation. Combining pre- and post-hourly energy usage data, customer survey responses, PV hourly production modeling results, and weather adjustments, major behavioral changes and system failures can be identified and their impact on energy savings can be assessed. This presentation will describe the methodology for quantifying PV program impacts when hourly AMI data are available and its advantages over previously used methods.

Danielle Côté-Schiff Kolp works at the Cadmus Group, Inc. as a Senior Analyst in the energy efficiency and renewable energy division. Ms. Kolp is a project manager for several program planning and evaluation projects ranging from industrial and residential retrofit programs to determining incentive levels and technical approval of renewable energy technologies. She also performs quantitative data analysis and cost-effectiveness analyses to aid in planning and evaluation efforts. Ms. Kolp received her master's degree from the Donald Bren School of Environmental Science and Management, UCSB.

Melissa Lapsa, Oak Ridge National Laboratory

Integrating Behavior into Electric Vehicle Charging Infrastructure Needs

On August 5, 2009, ECOTality North America, Inc. was awarded a \$99.8 million grant from the U.S. Department of Energy to embark on a project to electrify a portion of the nation's transportation system. ECOTality North America is partnering with Nissan North America to deploy up to 4,700 zero-emission electric vehicles, the Nissan LEAF, and 11,210 charging systems to support them in strategic markets in five states: Arizona, California, Oregon, Tennessee, and Washington. Beginning in 2010, the EV Project will collect and analyze data from chargers to characterize vehicle use and charging behavior in diverse topographic and climatic conditions, as well as data to evaluate the effectiveness of charge infrastructure, and conduct trials of various revenue systems for commercial and public charge infrastructure. The ultimate goal of The EV Project is to take the lessons learned—behavioral and technological—from the deployment of these first 4,700 EVs, and the charging infrastructure supporting them, to enable the streamlined, effective deployment of the next 5,000,000 EVs. To have quantifiable results, a significant effort is underway to place the infrastructure at homes of drivers with optimal projected use patterns and at public areas where drivers of EVs will choose to charge their vehicles. This presentation will provide an overview of the site selection process for the charging infrastructure in Tennessee and will describe the data collection process that aims to document "charging" behavior and the impacts of that behavior on the grid.

Melissa Lapsa, MBA, conducts market analysis that identifies opportunities to increase the deployment of energy saving technologies, including supply chain analysis, consumer behavior analysis, policy options research and strategic partnership development. She leads the ORNL Sustainable Campus Initiative – a lab-wide effort designed to integrate research and operations capabilities, to deploy leading-edge technologies, operational and business processes, and influence behavior in order to advance sustainability at work, home, and in the community.

Abstract

Short Bio

Vinson Lee, BC Hydro

BC Hydro: Building a Culture of Conservation

BC Hydro is a large electric utility servicing the province of British Columbia, Canada. One of their guiding principles is to develop and foster a conservation culture in British Columbia. Power Smart, BC Hydro's Demand Side Management (DSM) initiative, is responsible for leading BC Hydro's conservation and energy efficiency efforts to their customers. Power Smart assists customers in conserving energy, thereby saving energy costs and reducing environmental impact. BC Hydro established the Lead by Example department to manage efforts to ensure that the organization is practicing the same conservation ethic it promotes to its customers and to help foster a culture of conservation within the organization. A major achievement in the Lead by Example department is their "Green Teams" employee program. With 7000+ employees dispersed across the province at over 100 facilities, creating an effective employee engagement program is met with great challenges. Since 2008, the program has grown to over 200 Green Team members at 29 of their major sites which houses over 80% of their employee population. You will hear how the program utilizes social marketing techniques to motivate and encourage behaviour change and the different networking events and multi-media communications used to get their message out. You will also hear about the annual awards extravaganza which brings in employees from across the province to recognize some of the great efforts in conservation within the organization. This presentation provides examples of their successes in creating a culture of conservation as well as discussions about the many challenges the organization faces in this endeavour.

Presenter: Vinson Lee (Marketing Specialist for the Lead by Example department) Educational Background: Bachelors in Environmental Science (BSc) & Bachelors in Marketing (BBA) from Simon Fraser University (Burnaby, British Columbia, Canada) Professional Background: 2+ years at BC Hydro, Power Smart, Lead by Example with a focus on developing and implementing employee programs and communications to create awareness in conservation and to foster positive behaviour change.

Peter Lemoine, ICF International

It Takes a Village - We Energies' Community Education Pilot

As efficiency programs ramp up throughout the country, utilities are focusing on not only providing information and education, but also on measuring associated impacts. This presentation covers the design elements and implementation of We Energies' Community Education Pilot (CEP) program, and how energy savings is being measured for the program's behavior and educational components. Along with We Energies, ICF designed and is implementing the CEP program, which was approved by the Public Service Commission of Wisconsin, and will run for up to three years. The program is currently working with community leaders in a small town to reduce home and business energy use through social marketing and education techniques. The program does not offer financial incentives beyond those already available through other programs in the state. The evaluation methodology Itron has developed measures the behavior change and associated energy savings resulting from the CEP's enhanced marketing, facilitation, and communication efforts. The resulting impacts are measured by comparison with a control community. The control community selection is discussed along with the techniques used to measure the performance of the program. Itron has identified customer panels within the pilot and control communities that are used to track behavior change and energy usage throughout the pilot. This design allows Itron to examine the differences in awareness, behavior and energy usage over time across the communities to discern the impact of the CEP. If findings from the CEP support persistent energy savings, this initiative may be expanded to other communities.

Mr. Lemoine is a Senior Consultant with ICF International. He has worked for the past six years in the areas of energy policy, utility regulation, and DSM planning and analysis, as well as energy efficiency program evaluation.

Olga Livingston, Pacific Northwest National Laboratory

Impact of Behavioral and Demographic Factors on Residential NG Demand

With interest in human behavior and energy growing, the energy policy community is increasingly relying on pilot studies in evaluation of energy-saving measures. But for on-going programs this approach is not applicable. Econometric modeling can assist program evaluation and policy making for programs currently underway. However, the majority of econometric research on electricity and natural gas consumption to date relies on assuming a particular relationship between energy use and its covariates. As a result, there is always a potential for misspecification, which may misguide decision making. To improve our understanding of the factors affecting residential energy consumption, this paper discusses results of a novel nonparametric approach. This paper describes results of an additive nonparametric model for natural gas consumption, which is estimated using smooth backfitting. This procedure achieves convergence rates of univariate models, thus bypassing the “curse of dimensionality”. In addition, recognizing that both continuous and categorical variables impact energy demand, this application of smooth backfitting incorporates a kernel smoothing method for categorical data. This combined approach has not been attempted in the applied literature. We analyze impacts of behavioral and other factors on residential energy consumption at the microlevel using RECS 2005 data. The results of this analysis can be used for an in-sample prediction to approximate the energy demand of a building whose combination of characteristics has not been sampled. Also, this study provides information on how natural gas demand might change once a particular characteristic is altered.

Olga Livingston specializes in the areas of data analysis, market assessment, econometric modeling and analysis. Dr. Livingston is an industrial module developer for Stochastic Energy Deployment Systems. Other projects she is supporting include risk analysis for residential building technologies, quantification of energy efficiency in residential buildings, and analysis of the effects of behavioral variables on energy use. Dr. Livingston is also a developer of regional computable general equilibrium model in Mathematica. Her current research interests are econometric analysis and energy models.

Stephen Lorimer, University College London Energy Institute

Using Neighbourhood-Scale Marketing Data as Part of Modelling Home Electricity Use

Current domestic energy models in England currently only take floor area as an independent variable in the modeling electricity consumption of a home. This work compared the algorithm in place since 2009 with surveys of consumption in homes from 2002-2006 and census area-wide consumption for the year 2007 to examine the effectiveness of the model and the potential for improvement by adding in the variable of average income by area. Previous results showed that the model underestimated consumption, and the survey data did not match the amount of consumption in census areas at the top of the income scale, notably in a comparatively more heavily urbanised and wealthy London. This paper seeks to take the research further by disaggregating income groups using a marketing database named Mosaic available at the census area level in England. Mosaic’s main output is groupings of consumer behaviour for households, postcodes, and census areas. Their methodology is a ‘bottom-up clustering’ working method. Data on individuals and households, presumably consumer credit-related data, is then combined with census data from postcodes and census output areas. The correlated data at both household, postcode, and census output area levels are then given weights that are determined by a clustering effect at different levels of geography. Preliminary results show a phenomenon of members of the same socioeconomic group using similar amounts of electricity even in cases where income has doubled. They also show some differential between socioeconomic groups with similar income levels, especially at the lower end of the income spectrum.

Steve Lorimer is a town planner-urban designer and research student in the University College London Energy Institute, Bartlett Faculty of the Built Environment. He is currently writing his thesis on the impacts of socioeconomic profiles and urban structure of neighbourhoods on the energy modelling of electricity use in residential buildings. Formerly, he was an associate at the urban design and planning consultancy Urban Initiatives in London and Dublin. He was one of the primary authors of the Mayor of London’s Housing Design Manual, He was also one of the primary authors of the London Housing Design Manual, organising existing minimum dimensions and standards for urban design and domestic architecture for the Greater London Authority.

Robert Marans,

From Energy Conservation to an Integrated Assessment of Sustainability Practices: The University of Michigan Experience

As with households, organizations, and governmental units, universities are becoming increasingly aware of the long term implications of climate change and issues of sustainability. Their recognition has been driven in large part by rising energy costs; some universities have taken steps to address the problem by retrofitting their physical plant, building new structures that follow LEEDS standards, establishing programs that reduce transportation costs, and promoting sustainability among members of the university community. Some have even conducted experiments aimed at modifying the behavior of students and faculty. In the winter of 2006, the University of Michigan (UM) launched a pilot study designed to better understand the behavioral aspects of energy use among its faculty, staff and students. It was suggested that more effective policies and programs could be established if UM decision makers knew more about the energy consuming practices of these groups and how much they know about sustainability and the energy conservation initiatives taking place within the university. At the same time, the pilot study could help evaluate the effectiveness of programs that were already in place. In the spring of 2007 UM launched a new initiative to capitalize on what was learned in the study. Three energy conservation and behavior change teams were formed to individually educate building occupants, implement energy saving measures, and promote behavior change on energy usage and sustainable activities. This paper first describes the pilot study that was conducted in five UM buildings over a 10 month period. Besides gaining insights about what occupants knew, what they did with respect to energy use, and their views about their environment and energy conservation, the pilot study served as test of data collection and measurement procedures that could be applied to buildings and their occupants throughout the university. Next, the paper describes how study findings have been used to encourage behavioral change. After a review of how these techniques have been coupled with tradition energy conservation approaches throughout the university, the paper describes a current (2010) UM initiative aimed at assessing the issue of sustainability on campus including its human dimension dealing with public awareness, understanding, involvement, and behavior. The assessment has been designed to be comprehensive and focuses not only on buildings but also on transportation (commuting, inter-campus transit, walk/bike ability, tele-commuting), energy resources (solar, wind, biofuels), land and water (biodiversity, storm/waste water, fertilizer/pesticide, maintenance), food (local sourcing, organics, nutrition, composting), and purchasing (equipment, consumables, toxicity) and reuse/recycle/disposal. Finally, the paper concludes with a discussion of possible applications to other organizations including governments, NGOs, and corporations.

Robert W. Marans is a research professor at the Institute for Social Research and a professor emeritus of architecture and urban planning at the University of Michigan. During the past 40 years, Dr. Marans has conducted evaluative studies and research dealing with various aspects of communities, neighborhoods, and buildings. His research has focused on user requirements and the manner in which attributes of the physical and sociocultural environments influence individual and group behavior and the quality of community life. Much of Dr. Marans' research has been in the context of urban areas. His current research considers the impact of the built and natural environments on quality of life, issues of sustainability and energy conservation in the workplace.

Dave McColgin, Artefact

Good, Bad, and Missing - The State of Design for Change

When new products and experiences are created, designers define the context and discourse of interaction. They influence how people interact with each other and with their environment. Armed with this influence in the face of global challenges, designers have a responsibility to understand and contribute to effective principles for solutions developed by the broader community, and to innovate on the value of solutions to consumers. Traditionally, our mandate comes from understanding user needs and client goals. The objective good is a third input and has led to many new designs. So how are we doing? Using recent examples from design for residential resource efficiency, this talk will illustrate where the design community has been listening and where we go astray. Every day there is a new addition to the stream of control systems, monitoring devices, services, mobile applications, and appliances promising efficiency gains. Many implement effective principles for behavioral change, but others violate them or greenwash, even if inadvertently. In addition, key opportunities are being missed. As a whole, we are targeting only the reliable market of the motivated minority when we should be reaching even detractors, focusing only on direct selling to consumers rather than considering interested third-party players, failing to consider parallel advances like the complementary features of the Smart Grid, and creating uni-tasking solutions when we should be embedded with functional designs people need. The talk concludes using winning concepts from the 2010 International Design Excellence Awards to show how the gaps can be filled.

Dave McColgin is a researcher and designer at Artefact, a design consultant in Seattle, Washington. He was previously at Pacific Northwest National Laboratory and has worked and published on design for sustainability, information visualization, touch interaction, award-winning eLearning interactions, and more. He is not interested in shopping cart conversions. Dave studied brain & cognitive science and human-computer interaction, creating a passion for the intersection of technology with human needs and capabilities. He likes turning complex problems into useful and pleasurable experiences. Dave was proud to work on IDEA-winning concepts with Johanna Shoemaker and Jonas Buck of Carbon Design Group.

Rebecca Meyer, Connecticut Energy Efficiency Fund/CL&P

E3= Energy Efficiency Education

Since 2003, the Connecticut Energy Efficiency Fund, Connecticut Light & Power and United Illuminating have developed and administered the eesmarts program—a clean and efficient energy learning initiative for Connecticut school children Grades PreK-9. The program offers professional development workshops and inquiry-based lessons and activities. The eesmarts administrators work with leading math and science educational leaders—the Project to Increase Mastery of Mathematics and Science (PIMMS) out of Wesleyan University to develop hand-on, inquiry-based professional development. The in-depth, scientific and mathematical training allows educators, particularly those in the elementary grades, to feel comfortable regarding teaching the physical science of electricity, clean renewable energy sources and heat output of compact fluorescents. The training also helps educate students regarding the environmental and economic benefits that result from changing their behaviors or installing energy-efficient technologies. This training has proved beneficial to the implementation and use of eesmarts lessons in over 800 Connecticut educators' classrooms in 2008 and 2009. Post-workshop and curriculum use surveys indicate that educators are using the lessons as a part of their core lesson plans and are stressing the importance of energy-saving behaviors. As eesmarts lessons are fully aligned with Connecticut's mathematics and science frameworks, an educator can teach about energy conservation and the environment while meeting their educational district's and state's educational testing requirements. The presenter will also discuss the success of the 2010 eesmarts Summer Institutes, a month-long series of in-depth workshops for Connecticut educators that will include topical workshops on wind, solar and performing energy audits at home and in a school.

Meyer manages energy efficiency educational programs and outreach initiatives for the Connecticut Energy Efficiency Fund and Connecticut Light & Power. These initiatives include: eesmarts—a clean and efficient energy learning initiative for Grades PreK-9, designing and developing the Energy City Gallery at the Connecticut Science Center, and piloting the eeCommunities program to help Connecticut towns and clean energy task forces promote energy efficiency locally. Meyer worked previously as a telecommunications research assistant at a digital policy think tank in Washington, D.C. She has a BA in Political Science from NC State University and a MA in Environmental & Natural Resources Policy from George Washington University.

Asher Miller, Post Carbon Institute

Tales of Transition: A Community Movement Building a Future Without Fossil Fuels

Around the world a quiet movement is quickly spreading, made up of neighbors and community groups who are taking some of the world's most intractable crises--climate change, peak oil, and the economic downturn--into their own hands, and with a smile. Since its inception in 2006, the Transition Initiative movement has spread to over fifteen countries including throughout the United States, and gained the attention of some surprising people, including Prince Charles and Elle Magazine. Come here Transition US board member and Post Carbon Institute Executive Director, Asher Miller, share some insights about why the Transition approach has gained so much traction.

Asher became the Executive Director of Post Carbon Institute in October 2008, after having served as the manager of PCI's former Relocalization Network program. Prior to joining PCI Asher founded Climate Changers, an organization that inspires people to reduce their impact on the climate. Asher has served as a consultant to a number of other nonprofit organizations, including Just Think and Okizu Foundation. He currently serves on the boards of Transition United States and Listening for a Change, and on the Advisory Board of ErthNxt. He recently served as a member of Senator Edwards' Cleantech / Green Business Advisory Committee.

Houtan Moaveni, Florida Solar Energy Center, University of Central Florida

Deployment of Solar Cooling in the United States

The aim of this paper is to identify and minimize or remove barriers to solar cooling technology commercialization in the United States as quickly and efficiently as possible. The survey of the literature and personal correspondence indicates that the greatest barriers to the expanded use of solar cooling systems in the United States do not stem from technical obstacles, but from financial, political, and social hurdles. Moreover, due to lack of suitable design guidelines and tools or lack of public and policy-maker awareness, the economic and practical advantages of solar cooling need to be highlighted. The economics of solar energy systems are particularly complex with much inevitable uncertainty due to several factors. In this paper, a simplified comprehensive economic optimization model is developed to determine whether a particular solar technology is economically advantageous for a particular project. This model explains and illustrates with simple, but realistic examples the use of life-cycle cost analysis and benefit-cost analysis to evaluate and compare the economic efficiency of the solar cooling systems. However, practical experience shows that cost competitiveness does not automatically lead to a mass market. Policy options for deploying solar cooling are developed based on the results of this study, identification of main barriers of employing solar cooling system, surveys and a review of existing policies. These policy options enhance the economic feasibility of these solar energy applications to help policy-makers develop and implement suitable support policies for solar cooling. Toward that end, an estimation of the impact of these policies on the consumer and industry such as direct and indirect employment, profitability, competitiveness, etc is presented.

Houtan Moaveni graduated with a Master's Degree in "Energy Systems & Policies" from one of the most prestigious and the oldest universities in continental Europe "Ecole des Mines de Paris" and has a Bachelor's Degree in Electrical Engineering from one of Iran's most competitive schools to be admitted. He has qualification and experience in solar energy policy and the economics of solar power, design and survey of the operation of Concentrated Solar Power (CSP) systems, testing and performance and reliability evaluation of solar components and systems including both analytical and experimental research as well as several publications in these fields.

Christine Mondor, evolve environment::architecture

Building Up To Organizational Sustainability

Green building is often a gateway into organization-wide commitment to sustainability. Organizations that are exposed to sustainability through place-based initiatives such as the construction of buildings or landscapes share certain characteristics in their adoption of further sustainability initiatives. In addition, examining the predominance of nonprofit organizations as early adopters of both green building and organizational sustainability may reveal some structural reason for this market transforming trend. This report examines three nonprofit organizations that shifted focus to sustainability beginning with a green building project. Through their facilities, Phipps Conservatory, the Pittsburgh Opera, and the Greater Pittsburgh Community Food Bank each shifted from the second to the third order of business knowledge as they moved to a focus on the dynamics of enterprise/environment relationship (as described by Lazlo, 2001). This presentation will discuss their transformations to learning organizations as they grew their sustainability efforts through governance, policy, and initiatives. Each organization's mission was examined in relationship to sustainability, including what motivated the green building initiatives, the role of the change agent in changing social norms, the character and extent of green project initiatives, and the real and perceived benefits and costs of the projects. Each case tracked the effect on organizational learning and culture, the expanded goals and initiatives toward sustainability and changes to the organization's structure and governance to support the goals. Lastly, the presentation will propose a theory of change for organizations who want to adopt sustainability practices in the future.

Christine Mondor is an eternal optimist regarding the power of design in our environment. Her diverse experience enables her to note trends and technologies and bring benefit across project types, from residential and commercial to educational efforts to sustainability planning. Her design work has been recognized nationally and internationally and she brings strong experience with organizational dynamics. Christine has completed funded research on sustainable practices such as school abandonment and reuse and economics of sustainable technologies in office buildings. Christine teaches architecture, landscape and sustainability at Carnegie Mellon University. Christine is Registered Architect and a LEED Accredited Professional.

Leonardo Monteiro, Faculty of Architecture and Urbanism of University of Sao Paulo

Proposal of an Adaptive Model for Behavior Prediction in Function of Urban Outdoor Thermal Comfort

This research proposes an adaptive model for behavior prediction in terms of clothing thermal insulation and different metabolic rates according to activities, regarding urban outdoor thermal comfort. The proposition allows the verification of the thermal adequacy of urban outdoor spaces in the subtropics and the adaptive opportunities in such areas. The method adopted is empirical, by means of field research of microclimatic variables (air temperature, humidity and velocity, and mean radiant temperature), personal variables (clothing thermal insulation and metabolic rate according to activity) and subjective answers of thermal sensation and thermal comfort perception and preference. The field research consists of twenty-four different microclimatic scenarios and over a thousand hundred applied questionnaires, in three different urban situations: a sidewalk in a street canyon, an open square and a park fully shaded by the canopy of trees. Deductive method is also applied, by means of regression analysis. The significance of the results is verified by comparison with the ones obtained by simulation of different predictive models and respective indexes, considering the results from the different microclimatic conditions gathered in different urban situations from previous surveys. The results from the proposed adaptive model, compared with those from the others predictive models, showed that, for the specific subtropical microclimatic conditions, they present better correlations with the data gathered. Concluding one may observe the impact of the different microclimatic conditions in the use of the different typologies of urban spaces, predicting the behavior in function of outdoor thermal comfort in such areas of subtropical climate.

Graduate at Architecture and Urbanism from University of São Paulo, Ph.D. at Technology of Architecture and Urbanism in University of Sao Paulo with Sandwich Doctorate in Oxford Brookes University. Has experience in Architecture and Urbanism, focusing on Environmental Adequacy, Energy Efficiency, Sustainable Development, and Urban Thermal Simulation.

Carrie Nash, Northeast Energy Efficiency Partnerships

Making the Connection: Linking Communications Strategies to Market Transformation

The Communication Gap Many organizations working in complex fields and industries (such as energy efficiency), over-communicate about what they do, which programs they are working on, and the results of these programs. As such, these organizations get mired in the world of explanation and reporting neglecting communications that advance the mission. In an effective non-profit, the Communication Strategy must actually help advance the mission, not just explain the purpose of the organization. In the world of EE, this means that Communications must essentially take up the mantle of making EE a compelling, urgent, and easily understood concept for audiences both inside and outside the industry. NEEP's Solution: To advance our mission, Northeast Energy Efficiency Partnerships (NEEP) has dramatically shifted our communications strategy to adopt a market facing approach. The goal of this shift is to expand the audience of efficiency so that a broad population recognizes it as a clean energy resource and connects with the benefits it has on the planet, people and economy. The Results: The result is the availability of easily-digested case studies, factoids, educational tools, interactive media and resources that convert more people toward efficiency. Adding communications that are aimed at a broad and general audience to NEEP's deliverables will expand the audience of efficiency as a whole leading more people to connect with it in heart and mind. The implementation strategy involves an organizational shift at NEEP where marketing materials are recognized as project deliverables and all staff are trained to adjust their language. The presentations will discuss NEEP's research that resulted in the decision to adjust strategy, the platform for communication and the implementation strategy.

Annemarie Newman, Energy Center of Wisconsin

Mind the Gap: Discovering Missing Residential Energy Efficiency Messages

Wisconsin's utilities provide energy-saving information as a customer service and to help interested customers manage their energy consumption. Recent field and behavioral research suggests the existence of opportunities to help residential consumers reduce energy usage through energy education. The Energy Center of Wisconsin's "Consumer Energy Education & Messaging Research" project will assess areas in which utility customers would be well-served by new or improved energy conservation education and help utilities develop effective energy education customer messaging. The project presents a comprehensive approach to the deployment of effective energy efficiency messaging, from identification of utility consumer education gaps to message and delivery mechanism development and testing. The Energy Center will conduct a thorough analysis of opportunities to help customers reduce their energy usage through energy education, including:

- identifying energy-saving actions for which technical and behavioral research have identified awareness and information as the primary implementation barrier;
- gathering and reviewing consumer messaging and energy education to which customers of sponsoring utilities are exposed regularly;
- identifying educational opportunities that are currently not addressed;
- identifying educational opportunities in existing messaging or delivery mechanisms for which existing research offers more effective approaches; and
- reviewing existing research to determine the content and delivery mechanisms with the greatest promise to effectively address the identified gaps.

This BECC presentation will present gap and opportunity analysis results and offer examples of improved energy efficiency messaging tactics developed in adherence to current theories of behavior change and messaging that spur customer action.

With more than 15 years of experience in communications and the utility industry Annemarie has extensive experience communicating energy law, policy and engineering issues. Before her current position at the Energy Center of Wisconsin, she worked for American Transmission Company in project, stakeholder, media and corporate communications. She worked for ten years at the Public Service Commission of Wisconsin managing communications as the Public Information Officer and developing consumer and low income energy policy as a program and planning analyst. She holds a Bachelor's degree in Consumer Science from the University of Wisconsin-Madison and has completed graduate science communications courses.

Lauren Olson, Michigan State University

Challenges and successes of a certification program and educator network

The Green Certification program at Michigan State University provided a survey tool to communicate best practices, dispel myths, and create a social norms vis-à-vis a block leader approach applied predominately to an office environment. The role of block leaders allowed for peer-to-peer education, dispersing information through many messengers with the goal of creating normative changes. Block leaders, or environmental stewards as they are called at Michigan State University, currently number with over 600 stewards in 323 departments. This year, environmental stewards were charged with getting their department “Green Certified.” Green certification is a list of environmental best practices in the areas of waste, energy, water, and procurement. Assessors have the options yes, no, not applicable, and “plan to” for each characteristic. The program provides a means to encourage and track behaviors. Environmental stewards were engaged in developing the green certification surveys. In teams, the stewards developed separate surveys for offices, laboratories, information technology spaces, dining areas and kitchens, and campus living spaces. The teams piloted the forms prior to the launch 2009. Over one-third of units applied certification standards in the first year of the program. Most of these units passed or changed practices to meet the criteria. The presentation will discuss the lessons learned from this process and provide (as much as possible) a blueprint for implementing these programs.

Lauren Olson is the Project Coordinator in the Office of Campus Sustainability. Her work involves coordinating an Environmental Stewards Program, which seeks to involve many departments and units on campus to assist MSU in reaching its goals of decreased waste, increased recycling, and reduced energy consumption. In addition to all of that, Lauren also leads the effort to get MSU green certified, new program to recognize and assist units and students who are taking steps to reduce their environmental footprint. Lauren has a BS in Environmental Economics and Policy and a MS in Community, Agriculture, Recreation, and Resource Studies; both degrees are from Michigan State University.

Sara Peracca, Environmental Justice Solutions

Cooling the Earth: An Out of Classroom Primary School Behavioral Program

Cool the Earth, an out of classroom, elementary school program, engages family behavior change by enhancing children’s environmental awareness and motivation to act using incentives, monitoring and feedback, and monthly activities to reward and maintain motivation. Cool the Earth’s (CTE) program delivery model is driven by market research on the penetrability of schools in the face of standardized curriculum, testing, and in-flexible classroom time. Activities outside of the classroom are viable and with creativity can reach most children and their families to make behavior change. In CTE children are the primary conduits to their families (with additional parent information available via the website, school newsletters, and fliers). CTE aims to engage all of the children at a school and to equip them with tools to catalyze their parents to become better environmental stewards. CTE launches with a school-wide assembly featuring an original, age-appropriate play that informs children about climate change. Students then go home with a coupon book that lists 20 conservation actions, which highlight both the economic benefits and the carbon savings of each action. Children also participate in hands-on learning projects about energy-saving actions. Currently the program is conducted in over 100 schools, 14 states, and 3 countries. The mission of CTE is to build a program that is effective and scalable for all schools and communities. Scalability includes the packaging materials, support in selecting and training a school coordinator, maintaining frequent email and phone contact, required participation in evaluation, and website feedback on progress about actions.

Sara has worked with a range of environmental NGOs throughout the world over the last 20 years. Her experience includes research and management of projects focused on population environment dynamics, education, reproductive health, livelihood, and ecosystem management. She has a BA in Environmental Science and Political Science from Columbia University, an MS in Resource Ecology Management, an MPH in Population Planning and International Health, and a PhD in Social Demography from the University of Michigan.

James Pierce, Carnegie Mellon University

Considering (In)effectiveness of Energy Feedback Research and Design

Energy feedback systems, in particular residential energy feedback systems (REFS), have emerged as key area of focus for designers, engineers, researchers, and industries. However, we argue that researchers and others concerned with the design and evaluation of REFS should more strongly consider the *in*effectiveness of such systems, including not only potential limitations of specific types of REFS or REFS in general but also potentially counterproductive or harmful effects of REFS. We outline research questions and issues for future work based on critical gaps in REFS research identified from a review of REFS literature and findings from two qualitative studies of commercial home energy monitors. One of the key and most surprising research gaps we highlight is the lack of work investigating how REFS affect specific behaviors, attitudes, and understandings. There appears to be little disagreement that energy feedback “works”, with potential savings on the order of 7-20%; however little is known about what specific conservation behaviors do or do not result in such reported savings, how individuals engage or do not engage with feedback, or why conservation does or does not occur in relation to various types of feedback. We describe additional critical research gaps including: the effects of feedback on individual “experience”; social and cultural factors related to feedback; factors related to domestic consumption in terms of everyday practices; and broader critiques of energy feedback research including the philosophical assumptions underlying REFS research. Based on these research gaps and empirical findings, we frame areas for future work: design details, non-negotiable practices, identifying limitations and considering alternatives, unintended effects, and alternative aims.

James Pierce is a PhD candidate at the Human-Computer Interaction Institute at Carnegie Mellon University, where he works in the Living Environments Lab under the advisement of Dr. Eric Paulos. His work focuses on studying, designing and building interactive systems with the aim of exploring new applications of technology to the re-configuration of everyday practices for sustainability. James has published extensively on the topics of energy, sustainability and interactive design at top-tier conferences including ACM SIGCHI and DIS. He has a Master’s in Human-Computer Interaction Design from Indiana University and a bachelor’s in Applied Mathematics from the Illinois Institute of Technology.

Zachary Pousman, Georgia Institute of Technology

Using Imprint, An Interactive Kiosk Displaying Printer Data, to Engage Workgroup Communities in Sustainability

In office work, the “paperless office” predicted by the rise of information technologies has failed to materialize. In fact, businesses use more office paper today than they ever have, and experts predict that paper consumption for printing, copying, faxing, and general work-life will continue to grow. Small workgroups may have a vague sense of how their printing habits affect the use of printing resources, such as paper, toner, and energy to power the printers. Imprint, an interactive kiosk, provides workgroup members data-driven views into the stream of printer traffic including metrics and trends of resource usage. We report our design strategy, especially our intention to foster deeper conversations about sustainability amongst workgroup members, rather than heavy-handed quota limits or reducing office sustainability to a single metric. We will report findings from two pilot studies of 10-12 weeks each, and deliver conclusions about usability, usefulness, and impact of such systems.

Zachary Pousman is a Ph.D. Candidate in Human-Centered Computing at Georgia Tech. He is a member of the Information Interfaces laboratory headed by John Stasko. Zachary is also a member of the Graphics Visualization and Usability Center at Georgia Tech. Zachary’s research applies information visualization techniques to personal and workgroup data streams to provide novel views of everyday activity. I am not driven by a desire to optimize activities, but to open activities for inspection and personal meaning-making. My thesis explores issues of design and evaluation for systems whose usefulness lies in their ability to provoke new connections and conversations.

Cynthia Putnam, Northwest Energy Efficiency Council

Operator Training: Building the Skill Sets for Energy Performance

Operator training is designed to provide the skills and motivation to participants to understand and improve the energy performance of their buildings. Training curriculum is developed around learning objectives for a defined skill set such as use of key performance indicators for tracking energy consumption, symptom diagnosis of HVAC equipment, and routine investigation of building operating schedules. Studies of the national Building Operator Certification (BOC) program – a training and certification program in energy efficient operational practices - are showing that building operators who participate in training are more likely to engage energy efficient practices in the workplace. Several of these studies also attempt to quantify the behavior changes in deemed energy savings values. Can operator engagement of energy efficient practices be enhanced with delivery approaches that provide for both greater retention of training content and motivation? Recent research on utility-sponsored BOC programs suggest that delivery approaches can play a significant role in participant engagement of practice change and application in the building environment. This presentation will focus on a range of training approaches, including utility partnerships, that show promise for deepening the engagement of operators in addressing the energy performance. It will also identify factors in the workplace worthy of further exploration as possible contributors to operator engagement.

Cynthia has two decades of experience working with clients to implement energy management and resource conservation programs. She served on the management team of the Washington State Energy Office prior to establishing Putnam Price Group. She directs the national Building Operator Certification (BOC®) program, a professional training and certification in energy efficient operational practices for facilities engineers supporting ENERGY STAR® and LEED® initiatives. Her recent work focuses on strategic energy management planning services for clients in the healthcare and private commercial sectors. She has been a speaker at national conferences including the Summer Study of the American Council for an Energy Efficient Economy and World Workplace of the International Facility Management Association (IFMA). She is an instructor in the Sustainable Building Advisor Certificate Program sponsored by Seattle City Light and Seattle Central Community College. Cynthia is a board member of the IFMA Seattle Chapter and served on the Mayor's Green Building Task Force in the City of Seattle. She is a graduate of Cornell University and holds a Masters of Public Affairs.

Steve Raney, Cities21

iPooling: Instant Carpooling with Strangers: Industry Update

With traditional carpools, members are selected and then the carpool proceeds most weekdays for months without change. About 10% of US commuters carpool, but 80% of these are "fam-pools," carpools where members all live in the same home. With dynamic ridesharing (DRS), one-time carpools are arranged within 3 days of the trip. With iPhone, Droid, and other smartphones, "instant ridesharing" (IRS) is enabled, where one-time rides are arranged within minutes of the start of the trip. With IRS, a person may carpool every day, but with the flexibility of a different departure time and group of people each day. Every minute, there is a "river of empty seats" created by cars driving down the road. The idea of filling up empty seats to reduce traffic and CO2 emissions is somewhat obvious. Seven new companies have arisen to serve this market. While the "river of seats" is obvious, all 15 past DRS pilots failed. IRS/DRS names you might recognize include Avego, ZimRide, Goose Networks, Cartipicate, NuRide, GoLoco, Piggyback, RideNow, and Google RideFinder. In the movies, every stranger thumbing a ride is an axe-murderer. Companies have various approaches to addressing safety. Up to the early 1960's, US was a hitchhike-enabled country. Some countries currently enjoy a pro-hitchhiking social norm. If we are going to protect the climate, mass collaboration (such as IRS) is going to succeed.

Steve Raney holds a Columbia MBA, RPI computer science masters, and Berkeley transportation planning masters. He was Principal Investigator for the Environmental Protection Agency's "Transforming Office Parks into Transit Villages" study in Pleasanton. He is the author of ten U.S. Transportation Research Board papers. He has conducted technology product research for Microsoft, Citigroup, and Silicon Valley start-ups. His extensive qualitative and quantitative transportation behavior change research has focused on knowledge workers. His "smartphone carpool assistant and safety system," is patented. Raney is Executive Director, Cities21, a Palo Alto behavior change think tank.

Mark Rebman, BC Hydro

Analyzing the Consumption Effects of a 2-Step Residential Inclining Block Rate

A large electrical utility in Western Canada recently evaluated the energy and peak savings attributed to a new 2-Step residential inclining block rate . This rate applies two distinct charges separated by a consumption boundary of 1,350 kilowatt-hours per bi-monthly billing period. The first step rate applies to all energy consumed up to and including the threshold while the second pertains to all consumption above. Since the two charges differ substantially in absolute terms and may be further adjusted by widening the gap between them, a proper accounting of consumption effects must examine the price elasticity of demand within each step. Discussion will show that the conservation effect within each consumption block depends on the elasticity of demand and the change in the step price . The elasticities themselves are estimated by dividing total consumption by threshold level and regressing the resulting two consumption blocks on their corresponding step charges. The expected value of price elasticity at each step is the regression parameter associated with the natural logarithm of the step price in each of the resulting two equations. Other relevant variables included in the model are heating degree days, unemployment rate , service region, dwelling type and choice of heating fuel. For aggregate data, a general linear model may be used. By varying thresholds and stepped prices in conjunction with existing or proposed conservation programs, this model can be shown to accurately predict consumption effects arising from changes within the inclining rate structure.

Mr. Rebman has over 20 years of experience in the fields of Program Evaluation, Statistical Analysis and Economics. He holds advanced degrees from the United Kingdom and Canada in Operational Research and Public Administration with undergraduate preparation in mathematics and statistics. Mr. Rebman is currently employed evaluating energy conservation programs for BC Hydro, a large electrical utility in the Province of British Columbia, Canada.

Juliet Reiss, Chair of Corporate Policy and Marketing, RWTH Aachen University

Feedback: What Can be Learned from Prospect Theory?

Even though, consumer feedback is one of the most heavily researched energy conservation interventions findings in this field of research are mixed. Promising as well as poor results exist: whereas in some studies results suggest that feedback is an effective way of reducing energy usage in other studies applying feedback apparently fails. Such unresolved inconsistent findings suggest (next to carefully designed experiments which take into account numerous methodological challenges) a contingency model in which the focal question should shift from “Does feedback affect energy conservation behavior?” to “When does feedback affect energy conservation behavior?” Taking up this position Prospect Theory provides a particularly suitable but so far unemployed approach to feedback research. Owing to the fact that our perceptual apparatus is attuned to the evaluation of changes or differences rather than to the evaluation of absolute magnitudes Prospect Theory postulates that consumers do not perceive and evaluate stimuli in absolute but in relative terms. Applied to feedback research this means that information regarding the amount of energy used provided by feedback is either framed as a gain or as a loss depending on an internal reference point. The same usage level may imply heavy usage for one person but only low usage for another leading to differing behavior presumably. Prospect Theory includes further assumptions with enlightening insights for feedback research which will be one focus of this presentation. A discussion of possible alternative ways to conceptualize the empirical investigation will be another key subject. Furthermore, first empirical results will be presented.

Juliet holds a degree in Business Economics (Diplom Kauffrau). She is research assistant and PhD candidate at the Chair of Corporate Policy and Marketing, RWTH Aachen University. As a research assistant Juliet held various exercises at the RWTH and supervises students in writing their final thesis. Next to her work at the University Juliet consults companies in the chemical industry in the field of price management. Her core research interest is devoted to understanding consumer’s energy conservation behavior. Taking in a behavioral economics perspective she investigates the effectiveness of feedback on consumer behavior in her doctoral thesis.

Valerie Richardson, KEMA Inc.

First to Market

FIRST TO MARKET Texas and certain other parts of the US are undergoing a large-scale change in end use electric infrastructure with the deployment of smart meters. For customers and retail providers, a new era of technology-enabled electricity offers is unfolding. The impact of residential energy technology and time varying prices hinges upon several complex factors, including wholesale energy prices, technology development, policy and, ultimately, customer acceptance. With this project we set out to answer a fundamental question about the emergence of a smarter grid: what's in it for residential customers? Specifically, we assess the landscape of potential offers, their anticipated value to customers and corresponding adoption dynamics. Based on this analysis, we develop market size projections for a group of residential Smart Energy Offers ("SEOs"). Smart energy refers to the combination of electricity supply, its pricing and home energy technology. **Ten Themes & Views** 10 key themes and views emerged from the research and are addressed in this report; they are: 1. Customer awareness and interest are low. 2. Smart energy is a nascent market, but promises many new choices. 3. SEO benefits must be realized with little to no active management by customers. 4. Saving money is the key driver of customer value. 5. Wholesale procurement optionality is key to attaining SEO savings. 6. Texas is a unique, superior proving ground for smart energy. 7. We project adoption for primary SEOs will reach 8 - 12% in the coming 5 years. 8. The provider landscape is crowded, but no magic formula yet. 9. Prepay is the closest thing to a "killer app." 10. DLC and smart thermostats follow prepay in value and adoption. KEMA recruited 12 companies as sponsors to the study. The geographic focus of the research is Texas given the advanced deployment of advanced metering and the competitive dynamics of the Texas retail power market. The study approach included 1500 phone-based surveys among residential customers with electricity choice to gauge interest in smart energy offers and to assess customer experience and perceptions when choosing electricity providers. We also conducted a vendor survey and secondary research to assess the current and expected availability of devices and applications. The detailed findings of the study are proprietary and available only to study sponsors. However, we propose to present high-level results available for public viewing that expand on the 10 key themes mentioned above in either a poster or during a short discussion/exchange.

Valerie Richardson, currently a Senior Principal Consultant at KEMA Consulting; has nearly 26 years experience in marketing research, program evaluation, and project management. Her experience includes strategic planning, designing and implementing large-scale market assessments and measurement and evaluation projects. Before joining KEMA Inc., Ms. Richardson lead Pacific Gas and Electric Company's energy efficiency evaluation practice for nearly ten years where she represented PG&E as the lead witness for program evaluations in energy efficiency proceedings. Ms. Richardson has BA in Advertising/Marketing from San Jose State University and a MBA from Saint Mary's College in Moraga, CA.

Ryan Schuchard, BSR

Corporate Partnerships on Energy Efficiency with Suppliers in China

For global companies (here, “buyers”), helping suppliers to manage energy efficiency can be a practical way to make them more competitive, while offering a gateway for managing climate and other sustainability issues more meaningfully in supply chains. This is especially true in China, because it is a top location for energy-intensive manufacturing, it is the world’s No. 1 aggregate emitter of greenhouse gasses (GHG), and its government is providing more and more incentives for energy efficiency. But China presents to buyers a challenging landscape, and even companies with experience will have to adapt their approaches there. Key realities include:

- Government incentives generally do not yet focus on small and medium-sized enterprises (SMEs), which typify most suppliers.
- Energy efficiency often doesn’t make objective sense to suppliers given opportunity costs and their existing decision-making framework.
- Professional energy service providers lack financing capabilities and don’t target SMEs.
- Opacity and emergent standards keep buyers out.

Such obstacles are important because they help to define a buyer’s productive role, which includes:

- Providing insight by extending resources that orient suppliers to energy management and troubleshoot.
- Offering transparency tools that enable suppliers to gain more information for making decisions on their own.
- Introducing new incentives that make energy efficiency more attractive.

With their role understood, buyers should consider a four-phase, twelve-step road map for getting started: Build Foundations, Catalyze Suppliers, Facilitate Progress, and Grow Further. This abstract is based on a BSR report published in June 2010.

Ryan leads BSR’s practice in climate change. He recently managed BSR’s work launching Walmart’s supply chain energy efficiency initiative in Shenzhen, China, and has co-authored chapters in Corporate Responses to Climate Change (Greenleaf Publishing) and Carbon Trading (ICFAI Books), and numerous reports and articles. Ryan advises the Greenhouse Gas Protocol’s Scope 3 Initiative, the Electronics Industry Citizenship Coalition’s Supply Chain Carbon Reporting System and the China Energy and Climate Registry. Ryan has an M.B.A. from Thunderbird School of Global Management and a B.S. in Finance from Oregon State University and has served as a Peace Corps volunteer in Central Asia.

Daniel Schulte, Energy Market Innovations, Inc

Customer Selection for Critical Peak Pricing: Seeking Load Reductions Based on Behavior Change

Residential Critical Peak Pricing (CPP) is ultimately designed to reduce or shift load. To this end, several studies have shown programs targeting the residential sector make considerable contributions to utility portfolio goals. However, questions linger in terms of whether program eligibility and marketing design are strict enough to promote participation of customers that contribute to load reduction only because of their enrollment in a program. Preliminary results from an ongoing process evaluation at one utility suggest that some customers enroll in CPP programs because they previously “fit the profile” as opposed to being motivated to alter their consumption patterns during the critical peak. This evaluation, involving in-depth interviews with participants, has led the research team to contemplate several important questions such as: To what extent is CPP rewarding customers not actually contributing to load reduction? Must utilities approve or reward only those customers that modify their behavior once enrolling in CPP programs? How can process and impact evaluations complement one another to distinguish customers changing their behavior from those participating but not altering their energy use in any way? This presentation will review findings from the aforementioned process evaluation, present ideas for program design and requirements modifications (e.g. mutual use of smart meter data, distributing apposite information to potential participants, etc.), and seek fresh ideas from the audience on both design and evaluation of residential CPP programs by opening up the issue to discussion.

Daniel Schulte is a Project and Policy Analyst with EMI, supplying talent and enthusiasm to a variety of energy efficiency and demand response planning and evaluation projects. Mr. Schulte specializes in conducting interviews and surveys, developing case studies and reports, and providing policy and analytical support. His work with public and private utilities has provided the findings and ideas driving important decision-making for both effective design and comprehensive evaluation of energy efficiency programs. Mr. Schulte earned an M.A. in Urban and Environmental Policy and Planning from Tufts University and a B.S. from Indiana University’s School of Public and Environmental Affairs.

Daniel Schwartz, Carnegie Mellon University

Energy Programs: The Potential Environmental Cost of Saving Money

Electricity companies and government agencies offer various programs to reduce residential electricity usage, both in general and to reduce peak load. Energy programs can be framed as saving money or as saving the environment. Programs framed as producing monetary savings may be extrinsically motivating, while those focused on the environment may be intrinsically motivating. We hypothesized that the extrinsic motivation provided by monetary framings would undermine the intrinsic motivation to enroll in energy programs. The proposed study asks how the presentation of monetary and environmental frames shapes hypothetical decisions about enrolling in residential energy programs. Participants evaluated energy programs framed as saving money, the environment, or both. People were more willing to enroll in energy programs when they were described as producing environmental savings rather than monetary savings, or both kinds of savings. Similar patterns were found with other dependent variables. Our results provided no evidence of additive effects of combining environmental and financial framings. Thus, highlighting the extrinsic motivation to save money undermined the intrinsic motivation to save the environment. If so, then electricity companies may be better off highlighting the environmental savings of their energy programs, without explicitly mentioning the monetary savings.

I am a doctoral student in the Behavioral Decision Research program, at Carnegie Mellon University. I received my B.S. in Industrial Engineering from the Universidad de Chile, Santiago de Chile. Before I started my PhD program, I worked as consultant in the application of data analysis techniques to consumer's behavior, and as co-instructor of Introductory Economic Theory (Universidad de Chile). Currently, I am working in several projects applying key components of behavioral economics to environmental issues, especially on household energy consumption.

Kate Scott, Energy Trust of Oregon

Students as a Driver for Change: Energy Saving Educational Kits

It has been demonstrated that students can be profound drivers of change. Children can influence their parents as well as their communities at large. One example of equipping students with tools for communicating the importance of energy efficiency is the Energy Trust Living Wise Kits, educational kits which are distributed to 6th grade classrooms throughout Oregon. Kits contain energy saving measures, and teachers are provided a curriculum to teach the students about energy efficiency and conservation. In turn, the students take the kits home and install the devices with their parents. The Living Wise Educational Kits have proven successful for Energy Trust in generating cost-effective energy savings, as well as engaging teachers, students and families.

Kate Scott, Residential Project Manager, has been working on residential energy efficiency programs for Energy Trust of Oregon since 2006. Her areas of focus include behavioral energy savings efforts such as OPOWER and home energy monitoring devices, as well as other pilot efforts and initiatives to find new ways of delivering energy efficiency services. She is also currently pursuing a Graduate Certificate in Sustainability at Portland State University.

David Shepherd-Gaw, Washington State University Extension Energy Program

Why isn't there any FUN in Energy?

I have been experimenting with different ways to make energy (energy efficiency and renewables) more interesting and engaging to individuals locally and abroad. Attempting to develop and demonstrate programs, videos or other concepts to encourage positive behavior education as it relates to our consumption of energy. Having worked in this industry for over a decade and seeing utility programs, campaigns or initiatives, state efforts and others come and go. More or less, these efforts constitute dry and boring information tied to beneficial impacts that can no longer engage the attentions of our current society. My presentation will showcase examples of organizations that have attempted to put out engaging information to their audience and re-educate their audience on the importance of individual effort and saving energy, the earth, etc. with some FUN. This presentation will be supplemented with personal examples and concepts showing the viability of humor or creative interpretations (of energy-related topics) to make energy a heck of lot more fun!

David Shepherd-Gaw is an Energy Services Clearinghouse Manager for the Washington State University (WSU) Extension Energy Program, where he delivers energy information/services to U.S. businesses and consumers, manages special projects, and implements energy outreach programs. He develops new business opportunities, as well as communication and marketing strategies. Shepherd-Gaw has been with the WSU Extension Energy Program since 1998. He has a Bachelor of Science in Energy Studies from The Evergreen State College.

Debika Shome, Harmony Institute

Social Issue Entertainment 2.0: How Pop Culture and Behavioral Science can Motivate Change

Mainstream entertainment's influence on our cognition, emotions, and behavior is often profound. Mass media permeates both the public and private spheres of society, saturating communities with messages from a diverse range of sources. While advertisers regularly take advantage of the extensive reach and influence of the media, social scientists, policy makers, and nonprofits have seen little success in incorporating social messaging into entertainment. Harmony Institute's goal is to harness the power of mainstream media to provide US audiences with entertainment that educates on social and environmental issues and increases both individual and community action. The entertainment the Institute produces connects with viewers on both a cognitive and emotional level. Currently, the Harmony Institute is developing a range of media projects including: an issue-specific communications guide, web animation, online/offline game, and comic book. In my presentation, I will discuss why narrative and storytelling are the missing links to impactful messaging and how the Harmony Institute's unique methodology incorporates social and environmental messaging into narrative using behavioral science theory. I will highlight two recent media projects and their implications for encouraging pro-environmental attitudes and behavior among viewers. The first is a guide on net neutrality and open Internet access that shows how to craft a communications strategy that connects with audiences using behavioral science. The second is a game for at-risk youth that encourages civic engagement. These projects help establish Harmony Institute's methodology with measured impact that applies behavioral science theory and entertainment to environmental issues like climate change and energy efficiency.

Debika Shome is the Deputy Director of the Harmony Institute, a non-profit research institute that integrates the behavioral sciences with entertainment to influence positive social change. Prior to her work at Harmony, she served as the Assistant Director at Columbia University's Center for Research on Environmental Decisions (CRED) for five years. She co-authored *The Psychology of Climate Change Communication*, a climate change communication guide based on social science research released in November 2009. Debika's research interests include: public perceptions of climate change and motivating behavior change on social and environmental issues through narrative and entertainment. Debika completed her MPA from the University of Washington-Seattle. She holds an undergraduate degree in environmental science from Barnard College.

Dulcey Simpkins, E Source

Cooling Attitudes Toward Global Warming? A Meta-Analysis of Survey Data

Are American attitudes toward climate change "cooling off"? Some recent surveys seem to show that Americans care less about climate change than they did before the 2008 recession. Some national surveys such as the 2010 Pew Foundation Public Priorities Survey, the November 2009 Gallup poll, and the Yale-George Mason research on "Global Warming's Six Americas" support this view. At the same time, other research also shows that climate change is still a concern for a majority of Americans, and that it's not fading from public view. For example, the AP/Stanford environment poll from November 2009 shows no significant deterioration in Americans' concerns about global warming. Three out of four Americans feel that global warming will cause significant harm to future generations if not addressed, and a majority feel that the government should be doing something about it. Why do Americans respond in such seemingly contradictory ways about climate change? This presentation will use national surveys above, in addition to proprietary data at E Source, to investigate these seemingly irreconcilable findings. Through an examination of different drivers within the data such as political affiliation, regionalism, religious influence, age, and educational attainment, this presentation will help make sense of the data, and explain why some contradictions are cropping up. It will also show how the answer to the question "Is your concern about climate change increasing, decreasing or staying constant?" depends on whom and how we ask.

Dulcey Simpkins, a research manager at E source, investigates energy-efficiency and demand-response programs, as well as energy and climate policy. Her professional experience includes three years in the City of Ann Arbor's Energy Office implementing efficiency and alternative fuel programs; two years as the State of Michigan's Biomass Energy Coordinator; and two years managing clean tech economic development programs for the Department of Labor's WIRED grant in Mid-Michigan. She received a PhD in Political Science and a Master's Degree in Resource Policy and Management from the University of Michigan.

Troy Simpson, Global Green USA

Is this my problem? Inspiring Individual Accountability and Pro-Environmental Behavior

Inspiring individual action geared toward stemming climate change remains a considerable challenge. We contend that the onus for change may be considered more of a societal, as opposed to an individual, responsibility. To investigate this hypothesis, we conducted a nationwide study (N=170). Participants used 7-point scales (1=not at all, 7=very much) to indicate the degree to which they believed 3 distinct target groups varying in social distance should be held responsible for pro-environmental action. Participants then responded to a novel index designed to assess identification with the environmental movement. The results of a 2 (low vs. high green identity) x 3 (close others vs. local community vs. global community) mixed ANOVA with green identity as a between-subjects factor and target group as a within-subject variable indicated highly identified participants reported greater mean environmental responsibility ratings than low-identified participants across the three target groups ($F(1,140) = 81.6, p < .001$). Our findings further indicate that regardless of identification, participants hold socially distant groups more accountable for taking environmental action than individuals with whom participants have a more proximal social relationship. As a result of this understanding, Global Green is developing a Climate Action Initiative designed to contextualize climate change at the local and individual levels, and inspire individual responsibility for pro-environmental decision making through community-building and specific action items geared toward lifestyle choices, and community and political activism. Mr. Simpson's presentation will cover background research conducted at the University of Southern California and elements of the nascent Climate Action Initiative.

Troy Simpson is a Program Associate at Global Green USA, a national nonprofit organization founded by Mikhail S. Gorbachev. Headquartered in Santa Monica, California, Global Green works with government, industry, and individuals to facilitate practical changes that achieve goals in resource efficiency and sustainability. Mr. Simpson's experience stems from his work in the application of the principles of green urbanism, including municipal policy development and green building analysis. Troy began research on the social dimensions of climate change as a research assistant at the University of Southern California, and the Center for Research on Environmental Decisions at Columbia University.

Brian Smith, Pacific Gas and Electric Company

Institutions and the Choice Constraints They Impose

Public and private institutions have evolved to help improve the human wellbeing. With the advent of modern society, energy use from non-renewable resources has ballooned. This has been accompanied by increasingly larger and more complex public and private institutions in the energy arena. Given a concern for the non-sustainable nature of ongoing expansion of the energy sector with non-renewable sources, the public sector has increasingly sought to guide private actions through a variety of actions. This paper seeks to explore whether current practice in California may need significant changes to ensure the accelerated move needed to reach a sustainable energy future in the context of Global Climate Change. The focus is on whether public institutions are exerting effective governance in helping the development and evolution of all cost-effective energy efficiency options. The paper draws on the recent experience of publicly funded energy efficiency programs. Key roles played by public institutions (CEC, CPUC) and private entities (IOUs) are explored from a framework that seeks to understand policies and resulting energy efficiency interventions in terms of the institutional needs of key stakeholders. Author believes that the IOUs, the CPUC and the CEC have to re-examine the framework under which they operate and how they evaluate the success of the energy efficiency programs. Significant opportunities to leverage other EE market actors are being missed because of current rules and institutional behaviors of both the public and private entities involved. Paper also ends with an invitation to the social sciences to focus on helping resolve the institutional issues highlighted here. Paper should be of interest to administrators, overseers and social scientists who understand that it is not only about individuals and their choices, but also about how institutional frameworks allow or constrain opportunities.

Need biosketch

Mark Starik, George Washington University Institute for Sustainability

Social Media Practices and Possibilities for Sustainable Climate Solutions

Over the past decade, a number of new “social media” have arisen, taking advantage of the wider access of computers, the world-wide web, and advanced communication technologies for a number of purposes. These include blogs, wikis, Second Life, YouTube, Twitter, Facebook, Linked-In, and My Space, among other on-line tools and resources. While one of these purposes has been the increased on-line connection of individuals who share various traits, since global sustainability and attention to climate change have advanced significantly as salient issues over this same decade, many observers of both phenomena have begun investigating linkages between them, specifically, how advocates of sustainability have used or could use social media to advance these ecological and socio-economic goals. This study examines the wide range of social media that have been used by sustainable climate solutions advocates and initially identifies some common themes and current approaches in that usage. In addition, it provides several perspectives on some common trends in the connections between social media and sustainable climate advocacy, highlighting both the possible opportunities, such as increasing the reach of one’s sustainability influence, and the challenges, such as the distractions or misuse, of an expansion of such connections. Finally, it makes recommendations to sustainable climate action-oriented individuals, organizations, communities, and networks on how social media might be used more effectively for these purposes and what obstacles may need to be considered in advancing sustainable climate solutions through these social media in the future.

Mark Starik is a Professor and Department Chair of Strategic Management and Public Policy in the George Washington University School of Business. He researches, teaches, and advises organizations and individuals in the areas of Strategic Environmental Management, Environmental and Energy/Climate Policy, and Environmental Entrepreneurship. Mark is also the Director of the GW Sustainability Research, Education, & Policy and of the GW Institute for Corporate Responsibility Environmental Sustainability Program. He is a co-founder of the Academy of Management Organizations & the Natural Environment (ONE) Division and is a board member of several national and local non-profit organizations in Washington, D.C.

Susie Strife, University of Colorado

Moving Beyond Recycling: Normalizing Energy Conservation Behavior A Case Study of Teach for Sustainability in Boulder Colorado

Research shows that providing youth with opportunities to engage in environmental practices within their schools, neighborhoods and homes is an effective way to foster a child’s commitment to environmental behavior. An innovative approach to helping youth engage in place-based sustainability behavior is Teach for Sustainability (TfS). Teach for Sustainability is a collaborative effort between Boulder Valley School District, the University of Colorado, Symbiotic Engineering and Boulder County, bringing top environmental scientists, engineers, local government and educators together to implement an effective sustainability behavior change program. TfS combines standards-based sustainability curricula with resource consumption tracking software to motivate students and their families to participate in environmental behavior, especially energy conservation. TfS is unique in that it allows students to track the success of their own sustainability behavior at home, while fostering participation in friendly competitions among peer groups to reduce resource use. A web-based tool that interfaces directly with the student’s home utility billing data provides students with information about their homes’ energy and water use, and steps they can take to reduce their consumption. In January 2010, TfS launched a pilot phase in three schools in Boulder County and results will be analyzed at the end of May 2010. Based on the preliminary success of this pilot, the Governor’s Energy Office in Colorado is funding an expansion of the program to new schools. This presentation will cover the level of student participation, impacts on their homes’ energy use as well as key considerations for similar school-based behavior change programs.

Susie Strife received her PhD from the University of Colorado with a focus on environmental sociology and education for sustainability. Susie’s research, funded by NSF and the EPA investigated children’s emotional and behavioral reactions to environmental problems, positioning her for being a leader in the sustainability education field. Susie currently teaches undergraduate classes on Sustainability at the University of Colorado, creates elementary school curricula on energy efficiency and sustainability and works full time for the Boulder County Commissioners as the Sustainability Education Specialist managing the ClimateSmart Loan Program and directing the Retrofit Ramp-Up Grant funded by the Department of Energy.

Tom Syring, GDS Associates, Inc.

Loss Aversion Down on the Farm

One of the most robust findings of research on human behavior is loss aversion. People strongly prefer avoiding losses to acquiring gains. GDS Associates and Focus on Energy are using message framing to test loss aversion in the context of energy efficiency on dairy farms. We are sending letters to 400 farms that received energy audits through Focus on Energy in 2009. Each farm will receive one of two different letters referring to their energy audit, and encouraging them to implement an energy efficiency option. Letter one states that the farm is losing an annual amount of money each year, and recommends implementing an energy efficiency recommendation. Letter two states that the farm could save money each year by implementing an energy efficiency recommendation. Both letters ask the farmer to contact their Focus on Energy representative for help with implementing the recommendation. Our measure of response is the number of incoming contacts generated by each type of letter. This research varies from earlier work in two ways: 1) It is a field test on dairy farms. 2) It measures the response to a message of losing money against the response to a message about the potential to save money. Many prior tests of loss aversion frame the message in the terms loss or gain. Our findings may influence energy advisors to stress either: 1) that the farm is losing money with their current equipment, or 2) that the farm could save money if they installed new energy efficient equipment.

Tom Syring is a Masters candidate in Environment and Resources, and is in the Energy Analysis & Policy program at the University of Wisconsin - Madison. He holds Bachelors degrees in Economics and Landscape Architecture, and an undergraduate certificate in Environmental Studies. His research interest is in behavioral economics, particularly in the area of human behavior and energy use. Tom is a consultant at GDS Associates in Madison, Wisconsin, and primarily works on projects related to Wisconsin's Focus on Energy program. Prior to joining GDS, Tom was a teaching assistant in an introductory course on energy conservation at UW-Madison.

Brinda Thomas, Carnegie Mellon University

Non-Fungibility in Consumer Expenditures and The Rebound Effect

The rebound effect describes the case in which the potential energy efficiency savings from an investment in a good may not be fully realized, as reviewed extensively in Hertwich (2005), Greening et al (2000) and Herring et al (2007). Understanding the technical and decision-related mechanisms that influence whether (and to what extent) the rebound effect (both direct or indirect) occurs and for which energy end-uses can help policymakers design interventions to counter or limit this energy "takeback." Mental accounting (Thaler, 1985) offers a possible psychological basis for the energy rebound effect. Consumers may have a different marginal propensity to spend energy cost savings compared to other sources of income (Sheferin and Thaler, 1988). This would be an example of non-fungibility, or non-equal treatment of income depending on its source (Abeler and Marklein, 2008). Our work describes results from a survey-based test of the hypothesis that consumers display non-fungibility in energy cost savings. 213 Respondents recruited from Mechanical Turk.com were asked to consider that they received an annual bonus or an energy efficiency tax credit. Participants were then asked about their budget allocation preferences across of a range of categories from a randomly assigned windfall. Between-subjects t-tests of responses to both questions provides some evidence of non-fungibility, but limited evidence of planned responding of energy cost savings on the types of energy-intensive goods that would contribute to the rebound effect. Future work will expand the sample size and correlate results with environmental attitudes.

Brinda Thomas is a Ph.D. student at Carnegie Mellon's Engineering & Public Policy department, advised by Ines Azevedo and M. Granger Morgan. She has three years consulting experience with Sentech, Inc. and Navigant Consulting, working on energy efficiency and renewable energy projects for the U.S. Department of Energy. Her research interests include energy efficiency engineering and policy, demand-side management, and energy for development. She also has a B.S. in Physics from Stanford University.

Patricia Thompson, Sageview Associates

Smart Grid Surprises: When Customers do the Opposite of What We Expect

More and better information and control are typically thought to yield net conservation effects in the aggregate. Yet when testing smart grid technology deployment net increases in energy consumption have been observed in some segments, relative to status quo or in comparison to other older control technologies. Smart grid test data in our early deployment research demonstrated that the availability of home control systems led to increases in consumption as often as decreases. Worse, qualitative research demonstrated that those that increased consumption believed and bragged that they were saving relative to baseline, further exacerbating the problem. With the market investing many billions of dollars in smart grid technologies, we highlight a “predictably irrational” response (with apologies to Dan Ariely) in key segments. This research is consistent with other recent market findings showing increasing consumption in some segments however, we further demonstrate a consumer response model designed to achieve the savings promise of the smart grid. By treating behavior, price and technology as strategic, complementary (and interactive) investments rather than independent all or nothing treatments, better results can be achieved for utility and ratepayer.

Patricia Thompson, VP Regulatory Affairs Sageview Associates has 20+ years in the energy and environment. She is currently advising Duke Energy and others on efficiency and behavior investments. Her opening keynote at Metering Europe 2009 described the coming Marketing paradigm under Smart Grid. She teaches Marketing for AESP with Cadmus. Recent reviews include: Issues in Measuring and Crediting Behavioral Response from Feedback with EPRI and Cadmus; Lessons from Behavioral Initiatives for Northwest Energy Efficiency Taskforce on Marketing with Summit Blue. She is on advisory panels of California’s newly launching efficiency brand (DraftFcb), One Change.org and UC Berkeley’s Cleantech Institute.

Bill Thomsen, Menlo Atherton High School

Components of an Efficacious Student Taught High School Program

Many of the impacts of climate change will directly influence the lives of youth who are in high school. Further, youth are already engaging in activism to encourage behavior and policy change. Fifteen high school youth worked over one year to create a behavior-change focused climate curriculum on science, energy, transportation, and food that they taught to their younger peers. Program development involved weekend and noon meetings, climate science training, behavior science education, technology acquisition, presentation skills development, and content of energy, food and transportation relevant to climate change. Each student leader spent from 80-150 hours on program development. Evaluated program components include: four 30 minute video, animation, and imagery infused slide shows. The combination created an edutainment focused curriculum. Negative and positive (mostly humor) emotional video and visual components were strategically arrayed to engage students in content and encourage actions. Slides used a full screen visual image of the content with only 3-8 words per slide often with drop-in animation. Presentations to over 150 9th graders covered core content, student controlled behaviors, barriers and benefits. Accompanying printed materials covered facts, behavior monitoring and goal setting. In addition, students were given a Behavior Change Kit; a power strip, shower coach, clothes pins, tire gage, etc. Also each class included an interactive activity; a watt meter guessing contest, a parent-student role play on communicating on idling, and a local organic food tasting. All components were taught by older students. Presentation includes discussion of outcomes, engagement, satisfaction, perceived effectiveness and school institutionalization.

Mr. Thomsen is a senior at Menlo Atherton High School and one of the founding members of the Climate Change curriculum committee. Mr. Thomsen teaches about climate change regularly and is an active leader in the school community. He also coaches basketball for middle school teens.

Kaitlin Toner, Duke University

Excessive Choice and the Buffering Effect of Habit on Pro-Environmental Behavior

Over the past decade, Americans have been inundated by lists of ways to save the planet. Do these lists promote green behaviors or does an abundance of choice get in people's way? This research tested whether excessive choice undermines pro-environmental behavior and whether habit formation buffers against the burdens of choice. College students tracked their green behaviors over the course of a day. Amount of choice was manipulated by providing some participants with 6 pro-environmental behaviors (few options) from which to choose to perform that day and others with 24 behaviors (many options). In addition, each participant's pre-existing habit strength for each behavior was measured. As anticipated, for non-habitual green behaviors, high choice apparently depleted people's self-regulatory resources, leading them to fall short of their target. In contrast, for habitual green behaviors, high choice did not undermine performance because habits can be activated and implemented with few demands on self-regulatory capacity. The results suggest that pro-environmental messages and public policy interventions should take care not to burden consumers with excessive choice unless consumers have already formed habits for the target behaviors.

Kaitlin Toner is a graduate student in psychology at Duke University, working with Dr. Mark Leary. Prior to coming to Duke, Kaitlin obtained her B.A. from Tufts University (2006) and worked as a research assistant at Brandeis University. Her research focuses on the psychological processes that promote and deter environmentalism, specifically how self-regulation, habits, and self-presentational concerns affect the adoption and maintenance of pro-environmental behaviors. Kaitlin is a member of the American Psychological Association, the Association for Psychological Science, and the Society for Personality and Social Psychology and is the recipient of a National Science Foundation Graduate Research Fellowship.

Heather Truelove, Consortium for Risk Evaluation with Stakeholder Participation and Vanderbilt Institute for Energy and

Climate Change Beliefs and Support for Nuclear Power and Other Energy Sources

On the cusp of a nuclear energy renaissance, renewed attention to global climate change, and the potential for Congress to consider a new energy bill this year, an understanding of public support for various energy sources (especially nuclear) is warranted. This survey study represents the latest in a series of energy-related public perception surveys conducted as part of an ongoing project in the U.S. and aims to further probe the relationship between beliefs about global climate change and attitudes toward major energy sources (i.e., coal, hydro, natural gas, nuclear, oil, solar, wind, and biofuels). Telephone surveys using random digit dialing will be conducted on 2400 U.S. residents who live within 50 miles of a Department of Energy nuclear waste management facility (site-specific sample) as well as 600 U.S. residents who do not live near a nuclear waste management facility (national sample) between June and August, 2010. Questions will assess respondents' concern about global climate change (occurring, human-caused, seriousness), beliefs about whether various energy sources contribute significantly to global climate change, and support for increasing reliance on various energy sources. The focus of the analysis for this presentation will be on furthering our understanding of the relationship between climate change beliefs and nuclear power attitudes. Additionally, differences in attitudes and perceptions between the site-specific sample and the national sample will be explored. The results have important implications for our understanding of public perceptions of energy sources and the role climate change beliefs play in support for various energy sources.

Heather Barnes Truelove is a Research Associate at Vanderbilt University in the Consortium for Risk Evaluation with Stakeholder Participation and the Vanderbilt Institute for Energy and Environment. Her research interests center on the social psychology of proenvironmental behavior. Her current lines of research focus on investigating people's attitudes, beliefs, and perceptions of nuclear energy compared with other energy sources and examining the psychological variables that influence the performance of individual behaviors that mitigate climate change. Heather holds a Ph.D. in experimental psychology from Washington State University.

Junyi Zhang, Hiroshima University

A Comparative Analysis of Rebound Effects in Household In-Home and Out-Of-Home Energy Consumption in Asian Megacities

Household energy consumption comes from the use of electric appliances at home and vehicles outside to support various activity participations. Since ownership and usage of appliances at home and vehicles results in the reduction of disposal household income, in-home and out-of-home energy consumption might be interrelated with each other. In addition, these days, energy-saving technologies have been actively developed and have even become an indispensable part of products to win the competition in market. However, the introduction of energy-saving technology does not mean that household energy consumption will be automatically reduced. Households might become environmentally insensitive to their energy consumption behavior and as a result, total amount of energy consumption might even increase, i.e., the rebound effects might occur. Since energy-saving technologies in different appliances and vehicles have not been equally developed and households might show different preferences for these new technologies, and as a result the sources of the rebound effects might vary across appliances and vehicles as well as households. A comparative study is conducted with respect to Tokyo, Japan; Beijing, China; Jakarta, Indonesia, and Dhaka, Bangladesh based on a questionnaire survey. For this purpose, we collected the questionnaires from about 1,000 households in each city in 2009, which investigated the household energy consumption behavior over a year. Rebound effects are first examined based on an aggregate segmentation analysis, and then a structural equation model is applied to quantitatively measure the rebound effects in the four Asian megacities.

I have mainly published my research papers in the field of transportation. My research interests include activity and travel behavior analysis (survey, modeling, and policy), integrated urban modeling, environmental policies, and tourism policies. Since 2003, I have been involved in several big projects focusing on environmental issues in both developed and developing countries, funded by the central Japanese government. Currently, I'm the leader of the sub-program "Urban system design to prevent global warming" of the "Global Environmental Leader Education Program for Designing a Low Carbon Society" (2008~2012), Hiroshima University, Japan.