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[Back to the Future: Re-integrating Resource Planning with Open-Access Software](#)

Paul Meier, UW Energy Institute

[Mapping Software as an Evaluation and Program Management Tool](#)

Heidi Ochsner, Itron, Inc.

Jennifer Holmes, Itron, Inc.

Bob Ramirez, Itron

Dave Hanna, Itron

Shel Feldman, SFMC

Judy Mathewson, We Energies

[Taking a Bath on Showerhead Savings](#)

Kathryn Parlin, West Hill Energy and Computing, Inc.



[Solar Incentive Structures and the Impacts of PV Performance and Costs](#)

George Simons, Itron, Inc.

Kurt Scheuermann, Itron, Inc.

Myles O'Kelly, Itron, Inc.

Marvin Feldman, Itron, Inc.

Pierre Landry, Southern California Edison

[Conditional Demand Analysis of Residential Energy Consumption](#)

Ken Tiedemann, BC Hydro

[Duct Soup – Research and Impact Results for Duct Sealing Programs](#)

Elizabeth Titus, Northeast Energy Efficiency Partnership, Inc.

[CO<sub>2</sub> Trading Program Assessment: Recommendations for Kosovo](#)

Dafina Gashi, Rochester Institute of Technology

[Willingness to Pay for a Clear Night Sky: Use of the Contingent Valuation Method](#)

Stephanie Simpson, Student

## SESSION 1A

### **CLOSING THE LOOP: THE USE OF EVALUATION RESULTS BY PROGRAM MANAGERS**

*Moderator: Edward Vine, Lawrence Berkeley National Laboratory/California Institute  
for Energy and Environment*

#### PAPERS:

##### **Evaluation as a “Learning-by-Doing” Tool for the Implementation of Local Energy Efficiency Activities**

Jean-Sébastien Broc and Bernard Bourges, Ecole des Mines de Nantes  
Jérôme Adnot, Ecole des Mines de Paris

##### **The Importance and Influence of Evaluation in the Early Stages of Pilot Program Design and Planning: A Case Study**

Johna Roth and Nick Hall, TecMarket Works  
Rick Morgan, Morgan Marketing Partners  
Kathy Schroder, Duek Energy

##### **In it Together: Getting Evaluators and Implementers to Talk with One Another**

Shel Feldman, SFMC  
Judy Mathewson and Doug O’Brien, We Energies  
Jennifer Holmes, Itron, Inc.

##### **How Organizations Implement Evaluation Results**

Jane Peters, Research Into Action, Inc.  
Sharon Baggett, S.A. Baggett  
Patricia Gonzales and Paul DeCotis, NYSERDA  
Ben Bronfman, Quantec, LLC.

#### SESSION SUMMARY:

This session describes how program managers have used the results from the evaluations of their programs to implement improved programs. Four papers, representing work conducted in Europe, Kentucky, New York, and Wisconsin, are included in this session. The authors highlight both the challenges and opportunities in improving communication (closing the loop) between evaluators and implementers.

The first paper, “**Evaluation as a ‘Learning-by-Doing’ Tool for the Implementation of Local Energy Efficiency Activities,**” analyzes the gap between evaluation theory and practice. The authors review the issues linked to evaluation use and then provide suggestions for designing an evaluation methodology that focuses on integrating the evaluation in the operation process itself and on the usefulness of the evaluation outcomes. The application of this methodology is analyzed through a case study of a local promotion campaign of CFLs that was promoted in southeast France. The authors conclude that the main use of evaluation is not to quantify the results of a program but to learn how to work together, how to supervise and use an evaluation, and how to improve the operation management and the operations themselves. This way, the evaluation really appears to be a learning-by-doing tool for all stakeholders involved in the implementation of local energy efficiency activities. This is an excellent example of where U.S. evaluators can learn from our colleagues overseas!

The second paper, **“The Importance and Influence of Evaluation in the Early Stages of Pilot Program Design and Planning: A Case Study,”** describes the process of evaluating an energy efficiency program sponsored by Duke Energy in Kentucky over three years, focusing on evolving versions of a pilot program, so that it could be substantially improved before its formal launch. The focus of this paper is not so much on the program being evaluated, but on the ability of the evaluation effort to improve a program in its developmental and testing phase. The authors recommend that all newly designed or re-designed energy efficiency programs undergo this type of pilot testing that incorporates ongoing evaluations and early feedback approaches so that program problems and issues can be addressed before the program is launched to full scale.

The third paper, **“In it Together: Getting Evaluators and Implementers to Talk with One Another,”** describes the ongoing involvement of the evaluation team in discussions of program components and early looks at program activities impacts as part of the We Energies 55 MW Plan. The involvement of the evaluation team appears to have helped the sponsors and the implementation team identify information to be tracked and program features that reduce free ridership, as well as initiatives and implementation decisions with questionable cost effectiveness. At the same time, the resulting relationships entail additional costs and demand attention to maintaining the independence of the evaluation team. The authors conclude by stating that it remains to be seen whether the benefits achieved are limited to situations in which the sponsors are responsible for overseeing both implementation and evaluation, and where the sponsors have limited resources for program development

The fourth paper, **“How Organizations Implement Evaluation Results,”** discusses the results of a review of how the New York State Energy Research Development Authority (NYSERDA) used evaluation results during the first three years of program evaluation and places that in context of other organizations’ approach to evaluation. Three key components of evaluation utilization – organizational learning, direct utilization of evaluation recommendations, and evaluation capacity building – provide the context for the discussion of NYSERDA’s evaluation experience. The results of this review point to opportunities for improving the evaluation process at NYSERDA and demonstrate the value in conducting such a study – not only for NYSERDA but also for other organizations interested in “closing the loop” between evaluators and implementers.

# Evaluation as a "Learning-by-Doing" Tool for the Implementation of Local Energy Efficiency Activities

*Jean-Sébastien Broc, Ecole des Mines de Nantes, France*

*Bernard Bourges, Ecole des Mines de Nantes, France*

*Jérôme Adnot, Ecole des Mines de Paris, France*

## Abstract

With the "think global, act local" trends, local levels are taking an increasing role in the implementation of action plans, especially in the field of energy efficiency. An inventory of local energy efficiency operations in France confirmed a significant expansion of these activities, but also highlighted how rare their evaluation is, although a rich methodological evaluation material is available.

The research question for this study was then how to fill the gap between theory and practice. This was addressed through studying the issue of evaluation use. The first step was to find in the evaluation literature the key components of evaluation use and the success factors to overcome the barriers to evaluation practice previously identified. This was used to adjust our evaluation methods and approach, and then to apply this to a particular case study.

Key success factors for evaluation use were highlighted, such as the constructive and regular contacts between evaluators and program partners, and presenting the evaluation as a win-win collaboration.

Finally, the main evaluation use was not to quantify the results of the operation, even if it was initially the most important stakeholder expectation, but to learn how to work together, how to supervise and use an evaluation, and how to improve the operation management and the operations themselves. This way, the evaluation really appears to be a learning-by-doing tool for all stakeholders involved in the implementation of local energy efficiency activities.

# **The Importance and Influence of Evaluation in the Early Stages of Pilot Program Design and Planning: A Case Study**

*Johna Roth, TecMarket Works, Oregon, WI*

*Nick Hall, TecMarket Works, Oregon, WI*

*Rick Morgan, Morgan Marketing Partners, Madison, WI*

*Kathy Schroder, Duke Energy, Cincinnati, OH*

## **Abstract**

Evaluation professionals are typically asked to evaluate programs that are well into the post-development stages of their implementation cycle or after the program has run its course. However, conducting evaluations during the pilot stages of a program is an effective way to improve programs before they are fully implemented.

Duke Energy's low-income Payment Plus pilot program was evaluated three times while the program moved through a series of pilot program design changes. Each of these evaluations consisted of a process evaluation and an impact evaluation. The program offered a workshop on how to save energy, a workshop on how to manage a household budget, and free weatherization services for high-arrearage, low-income customers. Pilot participants were offered up to \$500 in bill credits in exchange for attending the workshops and having their homes weatherized.

These multiple evaluations conducted over a three-year period, focusing on evolving versions of the pilot program, helped to substantially improve the program before its formal launch. This paper informs the program design and delivery community of the benefits of conducting evaluations during the pilot or early implementation phases in order to fine-tune the program before it is formally offered to a wider distribution of customers. The focus of this paper is not so much on the program being evaluated, but on the ability of the evaluation effort to improve a program in its developmental and testing phase.

# **In It Together: Getting Evaluators and Implementers to Talk with One Another**

*Shel Feldman, SFMC, Middleton WI*  
*Judy Mathewson and Doug O'Brien, We Energies, Milwaukee WI*  
*Jennifer Holmes, Itron, Inc., Oakland CA*

## **ABSTRACT**

A great deal of discussion in recent years has focused on the need for program implementers to be responsive to changes in the market, including feedback from manufacturers, retailers, and customers. The experience of an ongoing demand-reduction program suggests the value of also obtaining and responding to feedback from evaluators throughout the program cycle.

This paper describes an effort to develop and maintain communication about program initiatives designed to reduce demand as part of the We Energies 55 MW Plan. It describes the background of the plan and the Company's rationale for bringing an evaluation team to the table during the initial planning and implementation efforts. Discussion covers We Energies' efforts to ensure ongoing communication, some results of those efforts, and some constraints that had to be imposed. Brief case studies then describe the vetting of a planned program component, the shaping of an initiative, and progressive modifications of a program delivery approach. A final section suggests some lessons learned from the perspectives of sponsors, implementers, evaluators, and regulators.

Overall, the approach taken by We Energies appears to have achieved several benefits, such as limiting free ridership and avoiding activities that are not likely to be cost-effective. At the same time, it is clear that nurturing the requisite relationships entails additional costs and demands attention to maintaining the independence of the evaluation team. It remains to be seen whether the benefits outweigh the costs and what factors may limit those benefits.

# How Organizations Implement Evaluation Results

*Jane S. Peters, Research Into Action, Inc., Portland, OR*

*Sharon A. Baggett, S.A. Baggett, Portland, OR*

*Patricia Gonzales, New York State Energy Research Development Authority, Albany, NY*

*Paul DeCotis, New York State Energy Research Development Authority, Albany, NY*

*Ben Bronfman, Quantec, LLC, Portland, OR*

## Abstract

The New York State Energy Research and Development Authority (NYSERDA) operates the **New York Energy \$mart<sup>SM</sup>** Program which is funded through a Systems Benefits Charge (SBC). In 2001, funding for evaluation increased from .05% to 2.0% of the overall program budget and the state policymakers concurrently raised their expectations for the evaluation of the program. In 2003, NYSERDA began a significant evaluation effort using four specialized contractors to provide evaluation services.

In 2005, the Process Evaluation specialty contractor was asked to conduct an assessment of the evaluation effort. The Evaluation Review, which is the subject of this paper, examined the first three annual cycles (2003-2006) through multiple interviews with 32 contacts (including program staff, NYSERDA Energy Analysis staff responsible for the evaluations, the four specialty evaluation contractors, and the co-chairs of the Advisory Group, which is comprised of stakeholders and oversees the evaluation of the SBC-funded programs) and a literature review. The interviews focused on NYSERDA staff experience with the evaluation process over the three-years, as well as the response of program staff to the recommendations provided in the evaluations. The literature review sought to identify best practices in evaluation utilization and evaluation capacity building for comparison to NYSERDA.

The results of the Evaluation Review demonstrate that NYSERDA is building evaluation capacity within program and Energy Analysis staff, that the evaluation approach is capable of meeting program and stakeholder needs, and that evaluation utilization is increasing over time. Relative to best practices, NYSERDA has demonstrated steady progress along a continuum that is common for other large organizations.



## SESSION 1B

### DOING IT BETTER! USING RESEARCH TO IMPROVE PROGRAMS AND EVALUATIONS

*Moderator: Ken Keating, PhD*

#### PAPERS:

##### **Myth-Busting Savings Calculations**

Dan Barbieri, Engineering Manager, RLW Analytics, Inc.

Eric Swan, Senior Engineer, RLW Analytics, Inc.

##### **Energy Efficiency Best Practices: What's New?**

The Latest from the Current Phase of Work for the National Programmatic Energy Efficiency Best Practices Study

Jennifer Fagan, Itron, Inc.

Michael Rufo, Itron, Inc.

Rafael Friedmann, Pacific Gas and Electric Company

##### **Integrating Process, Impact and Market Assessments: A Case Study in Maximizing the Value of Evaluation Results**

Tami Rasmussen, KEMA, Inc.

Peter Lemoine, KEMA, Inc.

##### **Evaluation Resuscitation: Breathing life into a slumbering evaluation group and defining the role of evaluation in the emerging 'utility of the future.'**

Rich Hazzard, Energy Market Innovations, Seattle, WA

Eric Brateng, Puget Sound Energy, Bellevue, WA

#### SESSION SUMMARY:

This session rests on the purposes of the evaluation conference for the last 24 years: to learn from the experiences of others and pass on information and ideas. Energy efficiency and its evaluations have been on an upward learning curve for nearly three decades. Yet some lessons need to be back-filled, if not re-learned. These authors all are documenting lessons of evaluation for others. The lessons: 1) don't assume anything that you haven't carefully tested; 2) look outside your experiences to find out what has worked elsewhere; 3) evaluation is a holistic enterprise; and 4) building organizational credibility and management support is essential to successful evaluation functions.

The paper on "Myth-Busting Savings Calculations" will be a good start to lively discussions on what we know and what we think we know. Many listeners will have examples of their own or will want to question some of those of the authors. With all the attention in evaluation on net-to-gross, we often forget that some of what appears "obvious" in gross savings is often unreliable, and may be even more important.

It may not have been "invented here," but learning from the experiences of others is the theme of "Best Practices" research. This paper looks at the Portfolio level of practice; examines non-residential information programs; and explores with experts where energy efficiency has opportunities to improve in the future.

The third paper reminds us the "Integrating Process and Impact Evaluation" isn't a catch phrase from the past, but still is a challenge today, when the tendency of analysts is to create silos and distinctions that can be dysfunctional. These authors use a single large program to illustrate the

advantages of a holistic approach to evaluation.

The last paper, "Evaluation Resuscitation," was selected from many abstracts submitted this year on the issue of establishing an evaluation function in organizations that may not have been doing a lot of evaluation over the years. This is one example, in one utility, but the lessons are very broadly applicable.

# **Myth-Busting Savings Calculations**

*Dan Barbieri, Engineering Manager, RLW Analytics, Inc.*

*Eric Swan, Senior Engineer, RLW Analytics, Inc.*

## **Abstract**

Myths abound in the calculation of energy program impacts. As a consulting firm with a broad clientele of energy companies, it is discouraging, almost shameful, how often we encounter the same errors, misconceptions, and pitfalls in the course of program evaluation.

In practice, energy and engineering companies make continuous adjustments to their computational methods in an effort to refine and improve the validity of energy and savings estimates. This reactive fine-tuning tends to occur at the program, utility, or regional level. The International Energy Program Evaluation Conference (IEPEC) is a biennial opportunity for leading evaluation engineers not to differentiate themselves, or showcase their wares, but to share their intellect and experiences. With the energy industry as uncertain as ever, we should embrace any chance to benefit from our collective experience and intellect. Mistakes should not be repeated, and myths must be debunked.

The authors, experienced professional engineers, have performed and/or managed ex-post evaluation of program impacts on well over a thousand energy-efficiency projects worldwide. This paper will share some of these experiences and feature case studies that involve popular energy myths, mistakes, and misnomers.

# **Energy Efficiency Best Practices: What's New?**

## **The Latest from the Current Phase of Work for the National Programmatic Energy Efficiency Best Practices Study**

*Jennifer Fagan, Itron, Inc.*

*Michael Rufo, Itron, Inc.*

*Rafael Friedmann, Pacific Gas and Electric Company*

### **Abstract**

This paper will present selected results and insights from the third phase of the national programmatic Energy Efficiency Best Practices study. The overall goal of the Best Practices Study is to identify and communicate excellent programmatic practices in order to enhance the design of energy efficiency programs in California and throughout the country. The first two phases of the study evaluated energy efficiency programs by program type, and type of program activity (e.g., marketing, tracking, implementation, management, etc.). They assessed applicable best practices for each program element, and delivered the analysis and data online via the project website ([www.eebestpractices.com](http://www.eebestpractices.com)). This study has enjoyed widespread use by many energy efficiency providers and practitioners around the U.S.

A key objective of the third phase of the study, currently underway, is to extend the assessment of Best Practices to include two new areas: (1) Energy Efficiency (EE) Portfolios and (2) Nonresidential Education and Training Programs; This paper will report on our research methods and high-level findings to-date for each of these areas.

A second project objective is to selectively update findings from the previous study via a “What’s New” white paper. This updated information refreshes the data contained in our project website for changes experienced since the study was first done in 2004. Also included are findings from our research on new program delivery strategies and technology trends, based on in-depth interviews with national energy efficiency experts from around the country. The paper will describe our research approach and present selected findings and recommendations based on the results.

A third key project objective is to disseminate information from the previous study phases to managers of Local and Third Party programs in California. This is being done via a combination of a training workshop and a tool to help program managers self-benchmark their own programs against the relevant best practices. The self-benchmarking tool is briefly described.

# **Integrating Process, Impact and Market Assessments: A Case Study in Maximizing the Value of Evaluation Results**

*Tami Rasmussen and Peter Lemoine, KEMA, Inc.*

## **Abstract**

California has recently experienced a major shift in evaluation management, with different entities managing 2006 program process and impact evaluations. As a result of this change, California program implementers and evaluators face uncertainty about the extent to which market, process and impact assessments will be coordinated in the near future. This paper examines the benefits and drawbacks of evaluation coordination and comprehensiveness. We use as an example the 2004-2005 California Statewide Multifamily Rebate Program evaluation. This comprehensive evaluation helped bring crucial and timely information in a most efficient manner to program managers allowing them to adjust their programs and savings claims and begin to adapt to changing multifamily market and programmatic contexts.

The paper concludes that the current evaluation approach in California allows for more flexibility than prior approaches, since funding levels will be determined at the program or sector level based on evaluation need rather than an a priori prescribed basis, enhancing efficiency of the portfolio of evaluations. However, there is likely to be missed opportunities and inefficiencies at the program evaluation level due to the absence of coordination across evaluations. The paper recommends the establishment of an explicit mechanism for coordination of early and ongoing feedback of evaluation scope, methods and results for both process and impact evaluations. This would allow for coordination of research activities across evaluations, which could increase efficiency of resources and minimize respondent fatigue. Likewise, program managers and evaluators would learn of evaluation results on a timely basis and adapt programs and evaluation approaches accordingly.

# **Evaluation Resuscitation: Breathing life into a slumbering evaluation group and defining the role of evaluation in the emerging ‘utility of the future’**

*Rich Hazzard, Energy Market Innovations, Seattle, WA*  
*Eric Brateng, Puget Sound Energy, Bellevue, WA*

## **Abstract**

Since 2002, Puget Sound Energy’s Energy Efficiency Services (EES) programs have experienced significant growth. Energy savings targets, driven largely by a renewed upper management commitment, and direction provided by Integrated Resource Plans, have more than doubled 2002 levels. In 2006, annual energy savings totaled 166,254 MWh and 2,377,244 Therms with total EES expenditures of \$35,455,000.

Because of this significant growth in the overall portfolio of EES programs, the evaluation group was challenged to plan and implement projects to meet the emerging, increasingly complex market research and evaluation demands of the utility’s regulatory, planning and implementation stakeholders.

Working with an independent consultant starting in early 2006, the utility engaged in a comprehensive approach to evaluation planning that would address:

- Limited internal resources for evaluation of programs
- Organizational demand to ensure claimed savings were “as pure as the new driven snow”
- Recent Integrated Resource Plans (IRP) that placed energy efficiency in the resource acquisition category
- Anticipated regulatory action to attach a financial incentive to exceed energy savings targets

This paper will review the project rationale, present the detailed evaluation planning process, share the organizational and communication tools developed, and offer analysis of the overall impact the new evaluation processes have had on the planning, implementation and regulatory stakeholder groups.

## SESSION 1C

### EVALUATION RULES! PROTOCOLS AND FRAMEWORKS

*Moderator: Elizabeth Titus, Northeast Energy Efficiency Partnerships, Inc.*

#### PAPERS:

##### **Building Bridges Between Energy Efficiency Program Evaluation and Greenhouse Gas Mitigation Quantification Protocols**

David Sumi, PA Consulting Group

Bryan Ward, PA Consulting Group

Nick Hall, TecMarket Works

##### **Developing Protocols to Estimate Load Impacts from Demand Response Programs and Cost-Effectiveness Methods – Rulemaking Work in California**

Daniel Violette, Summit Blue Consulting Practice, LLC

David Hungerford, California Energy Commission

##### **Starting Over – Developing an Evaluation Framework and Protocols in Ontario**

Mike Messenger, Ontario Power Authority

##### **New Evaluation Framework: Turning the Silo on its Side**

Cherie Gregoire, New York State Energy and Research Authority

Jennifer Meissner, New York State Energy and Research Authority

Patricia Gonzales, New York State Energy and Research Authority

Victoria Engel, New York State Energy and Research Authority

##### **The Integration of Energy Efficiency, Renewable Energy, Demand Response and Climate Change: Challenges and Opportunities for Evaluators and Planners**

Edward Vine, Lawrence Berkeley National Laboratory

#### SESSION SUMMARY:

This session will focus on standard approaches to measurement and evaluation of energy efficiency programs to meet various new and emerging policy and program needs. Combined, the set of four papers provides a range of examples of protocols and frameworks as well as critical thinking about what key elements are needed in successful protocols and frameworks, the process of developing frameworks, and how evaluation efforts fit into these. The relationships between form and function and other insights are very relevant given the emerging need to integrate energy efficiency program evaluation with other energy cultures such as demand response, climate change, and renewable energy.

David Sumi addresses how efficiency program sponsors, including regional and state agencies, can realize emissions-associated benefits from their programs. He compares the Greenhouse Gas Protocol for Project Accounting from the World Resources Institute and the California Energy Efficiency Evaluation Protocols. He reviews current reporting requirements concerning combustion emissions for which energy efficiency program actions are eligible in a market or for regulatory compliance. Finally, he explores how can energy efficiency programs maximize the value of emissions credits?

Dan Violette proposes evaluation frameworks for various types of Demand Response programs. The recommendations are based on a review of issues encountered in the development of California Energy Efficiency Evaluation Protocols and other related work in the load estimation field.



Mike Messenger describes the protocols established for measurement of energy efficiency in Ontario in the context of the development of the overall evaluation infrastructure. The process began with a situational assessment of how current practice compared with best practice. A set of goals and a multiyear plan were established, followed by establishment of infrastructure.

Cherie Gregoire outlines development and implementation of the organizational framework in use at NYSERDA to meet its evaluation needs. NYSERDA moved from a core evaluation team organized by sector to a more functionally-organized model, in which tasks fall into one of three areas: impact, process, and market characterization.

# **Building Bridges Between Energy Efficiency Program Evaluation and Greenhouse Gas Mitigation Quantification Protocols**

*Dr. David H. Sumi, PA Consulting Group, Madison, WI*

*Bryan Ward, PA Consulting Group, Madison, WI*

*Nick Hall, TecMarket Works, Oregon, WI*

## **Abstract**

Markets and regulatory imperatives are emerging that will assign value to grid-connected and site-specific avoided emissions where the emission reduction source is energy efficiency (EE) programs. However, while EE programs – and the associated reduced combustion emissions from generating grid-connected electricity in the U.S. – are increasingly a qualifying activity for these markets, the protocols of the emissions markets and EE sector have not been mapped onto each other. This paper examines some of the gaps – and what needs to happen to close those gaps – to ensure that energy efficiency initiatives play a significant role in GHG mitigation efforts.

# **Developing Protocols to Estimate Load Impacts from Demand Response Programs and Cost-Effectiveness Methods -- Rulemaking Work in California**

*Dr. Daniel M. Violette, Summit Blue Consulting, Boulder, CO  
Dr. David Hungerford, California Energy Commission, Sacramento, CA*

## **Abstract**

California is engaged in a process designed to produce a set of protocols for estimating the load impacts of different types of Demand Response (DR) programs. These DR impact estimation protocols will serve as a companion document to the California Energy Efficiency Evaluation Protocols adopted in April 2006. This work was initiated by CPUC Decision D.05-011-099 resulting in Rulemaking Docket R.07-01-041. When completed, the protocols will be used to guide the processes and efforts associated with estimating the load impacts of California's demand response programs.

This paper will focus on the issues and estimation approaches that were identified in the first draft Protocols document.<sup>1</sup> The issues were identified as needing resolution with regard to the application of different methods for estimating load impacts from DR programs in varied settings. An initial set of "Impact Issues" were defined reflecting choices that need to be made when selecting approaches for estimating the DR program load impacts. As part of this CPUC rulemaking, the investor owned utilities (IOUs) in California are to submit "straw" proposals for addressing the DR Impact Estimation Protocols by August 2007. Estimating DR impacts across different sectors and program types has raised new program evaluation questions. This paper presents the ongoing work and results being produced by this CPUC rulemaking effort.

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<sup>1</sup> "Draft Version 1 – Protocols for Estimating the Load Impacts From DR Programs," Prepared for the California Energy Commission Working Group 2, Measurement and Evaluation Committee, Summit Blue Consulting, LLC and Quantum Consulting, Inc. April 3, 2006.

# Starting Over – Developing an Evaluation Framework and Protocols in Ontario

*Michael Messenger, Independent Consultant for the Ontario Power Authority  
Toronto, Ontario*

## **Abstract**

This paper tests the hypothesis that it is both possible and desirable to transfer energy savings evaluation protocols across jurisdictions or states in developed countries. An experiment is underway attempting to transfer the structure and insights from California's measurement and evaluation (M&E) protocols to the province of Ontario. The results of this experiment suggest that it is possible to transfer M&E protocols and evaluation practices across states or jurisdictions but the levels of rigor and comprehensiveness need to be revised to reflect the realities of local evaluation practices. This paper discusses the short-term results to date associated with the transfer of M&E methods and principles to the Ontario planning and evaluation system. Finally, a summary of lessons learned is provided that may be useful for other practitioners attempting to transfer M&E protocols across jurisdictions.

# **New Evaluation Framework: Turning the Silo on its Side<sup>1</sup>**

*Cherie Gregoire, Jennifer Meissner, Patricia Gonzales, and Victoria Engel, New York State Energy Research and Development Authority, Albany, NY*

## **ABSTRACT**

This paper describes the nimble evolution of an evaluation framework that succeeds in providing a credible and comprehensive evaluation of a portfolio of energy efficiency, demand reduction and renewable energy programs. The new model provides timely information to stakeholders, managers, and staff about the impacts, efficiency, and effectiveness of program implementation; progress in transforming constituent markets; the economic impact and cost-effectiveness of programs; and progress toward public policy goals.

Prior to 2003, evaluation was conducted by a small internal staff with limited assistance from two external contractors. With an influx of program funding, the evaluation effort was expanded to use four contractor teams to provide: program theory and logic; market characterization, assessment, and causality; measurement and verification; and process evaluation services. Rather than the typical model of one contractor performing all evaluation services segregated by program or sector, each team had a single evaluation function across all sectors. The premise was that evaluation experts in a particular field are better suited to ensure that the successes and shortcomings of diverse programs are accurately, appropriately and objectively measured and reported. This approach provides several advantages:

- better integration of results
- more consistent approaches
- fewer evaluation contracts to administer
- improved coordination between evaluators

In 2006, the number of specialty evaluation contractor modalities was reduced to three to address: impact evaluation; process assessment and evaluation management; and market characterization and assessment evaluation. This constitutes a streamlined approach while still maintaining the key building blocks of a comprehensive evaluation.

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<sup>1</sup> The views expressed in this paper are those of the authors and do not necessarily reflect the views of the New York State Energy Research and Development Authority.

# **The Integration of Energy Efficiency, Renewable Energy, Demand Response and Climate Change: Challenges and Opportunities for Evaluators and Planners**

*Edward Vine, Lawrence Berkeley National Laboratory, Berkeley, CA*

## **Abstract**

This paper explores the feasibility of integrating energy efficiency program evaluation with the emerging need for the evaluation of programs from different “energy cultures” (demand response, renewable energy, and climate change). The paper reviews key features and information needs of the energy cultures and critically reviews the opportunities and challenges associated with integrating these with energy efficiency program evaluation. There is a need to integrate the different policy arenas where energy efficiency, demand response, and climate change programs are developed, and there are positive signs that this integration is starting to occur.

## SESSION 1D

### A DIAMOND IN THE ROUGH

*Moderator: Paul DeCotis, NYSERDA*

#### PAPERS:

##### **Chasing O&M Savings: Process Lesson from Two Pilot Programs in the Northwest**

Linda Dethman, Dethman and Associates

Rick Kunkle, WSU Energy Program

Phil Degens, Energy Trust of Oregon

##### **Finding Hidden Energy Savings: Operational, Maintenance and Behavioral Savings for Large Commercial Customers**

Margo Longland, BC Hydro

##### **How Much Does Retrocommissioning Really Save? Results From Three Commissioning Program Evaluations in California**

Bing Tso, SBW Consulting, Inc.

Nick Hall, TecMarket Works

Peter Lai, California Public Utilities Commission

Richard Pulliam, Southern California Edison

##### **Lessons Learned from a Decade of Evaluating Customized Commercial and Industrial Efficiency Measures**

David Jacobson, National Grid

Eric N. Studer, PE, DMI

#### SESSION SUMMARY:

This session describes how efficiency program design and delivery targeted at the commercial/industrial sector can be supported through evaluations. The focus is on O&M and building envelope tune-up. The first paper compares two pilot programs seeking O&M energy savings. A key element of the findings is that the time and commitment needed to develop and deliver new O&M service offerings are likely to exceed even the most generous expectations of program planners and implementers. For even some of the most basic efficiency elements, completing the project will likely take over a year. The second paper describes the development of a choice model, which is a quantitative statistical method for predicting customers' voluntary decisions to participate in energy efficiency incentive programs and implement efficiency measures. Using data from program participants and non-participants, the paper discusses findings of lower-than-expected net energy savings, which may have been influenced by initial program design and implementation decisions and competition from similar offerings. Results from impact evaluations of three retrocommissioning programs are discussed in the third paper. The study contributes to testing the hypothesis that achieved retrocommissioning savings may not be as strong as predicted. A sample of 36 large commercial buildings was evaluated using a variety of techniques and data sources. As discussed in the first paper, this study also found the long duration of projects poses challenges for program designers and evaluators, as does the nature and complexity of many retrocommissioning projects. Determining the impact of custom efficiency measures is the subject of the final paper. As the low-hanging fruit, *i.e.* energy savings, of standard measures is harvested, the focus shifts to custom measures where savings is less predictable and support for programs may wane if expectations are not met. Potential pitfalls for program implementers,

uncovered through years of evaluation experience, are described, and program policy and implementation recommendations are offered.



# Chasing O&M Savings: Process Lessons from Two Pilot Programs in the Northwest

*Linda Dethman, Dethman and Associates, Seattle, WA*

*Rick Kunkle, WSU Energy Program, Olympia, WA*

*Phil Degens, Energy Trust of Oregon, Portland, OR*

## Abstract

This paper compares two programs that were designed to convince building owners and service providers to implement energy saving operations and maintenance (O&M) improvements in existing commercial buildings. Using information collected in two process evaluations conducted over several years, we highlight the differences in the approaches used and describe which components worked well and which were less successful. We explore how each program developed and introduced a new program to utilities, service providers, and owners and the challenges they encountered. We also discuss the challenges involved in evaluating these pilot programs, including evaluating a pilot program when market transformation is a key goal.

Key lessons learned from evaluating these two programs include:

1. Clear and agreed upon goals, outcomes, and delivery processes move projects more smoothly through the process and produce more predictable and consistent results.
2. The experience and approach of service providers greatly affects the recommended measures.
3. Documenting and verifying measures is especially challenging due to the nature of many O&M measures.
4. The time and commitment needed to develop and deliver new O&M service offerings are likely to exceed even the most generous expectations of program planners and implementers.
5. Evaluations of O&M programs, especially within a market transformation context, pose significant challenges.

# **Finding Hidden Energy Savings: Operational, Maintenance and Behavioral Savings for Large Commercial Customers**

*Margo Longland, BC Hydro, Vancouver, British Columbia, Canada*

## **Abstract**

This paper summarizes an impact evaluation of BC Hydro's e.Points Bonus initiative for large commercial customers. e.Points Bonus rewards customers participating in BC Hydro's Power Smart Partner program for improvements in aggregate energy efficiency measured over customer sub-accounts and sites. The program assumes energy savings primarily arise from behavioral, operational, and maintenance savings. This evaluation explores: (1) customer participation using an econometric choice model; (2) gross and net energy savings associated with energy efficient behavioral, operational, and maintenance activities; and (3) how to distinguish program savings from savings previously claimed by other programs. Gross savings were calculated using 60 months of consumption data for participants and non-participants in a pre-post comparison design with a comparison group.

Key findings: (1) Freerider rates are 66% based on survey responses. (2) Significant influences on participation include frequency of contact with the Account Manager, number of employees, sector, and the incidence of previous energy efficiency projects with BC Hydro. (3) 73% of the gross aggregated energy savings associated with other BC Hydro Power Smart programs are realised in the customer billing data. The generalized realization rate confirms previous evaluation findings for the Power Smart Partner incentive program. (4) Gross and net energy savings for the reward initiative are 13.6 GWh and 4.6 GWh respectively (or 35% and 12% of reported savings). The results were used to recalibrate program reported energy savings.

# **How Much Does Retrocommissioning Really Save? Results From Three Commissioning Program Evaluations in California**

*Bing Tso – SBW Consulting, Inc.*

*Nick Hall – TecMarket Works*

*Peter Lai – California Public Utilities Commission*

*Richard Pulliam – Southern California Edison*

## **ABSTRACT**

Energy-focused retrocommissioning has been and continues to be an important element of the energy savings portfolio in California. Rigorously quantifying the realized savings, though, is particularly challenging. Retrocommissioning programs often have complex implementation processes that span years, and assessing their impacts requires a high level of technical skill and evaluation judgment. This paper discusses the impact evaluations of three major programs that have taken place over the past several years, namely, the 2002-2003 Oakland Energy Partners Large Commercial Building Tune-Up Program, the 2004-2005 Building Tune-Up Program, and the 2004-2005 Monitoring-Based Commissioning element of the UC/CSU/IOU Statewide Energy Efficiency Partnership. A key objective of the state-funded evaluations of these three programs was to assess actual reductions in energy and peak demand savings, as well as the useful lifetime of these savings. The findings have helped determine how cost-effective retrocommissioning programs are, as well as ways in which they could be improved.

The Statewide Energy Efficiency Partnership evaluation is still in progress, but the two Building Tune-Up evaluations found that realized energy savings were significantly lower than program goals and claims. This paper discusses the reasons for this, why they varied, and the methods used to assess this. It also provides recommendations for improving savings estimation and results for future programs. These recommendations include improved program communication to support evaluation activities, additional measure commissioning, measurement and verification support throughout, and assistance to encourage savings persistence.

# **Lessons Learned from a Decade of Evaluating Customized Commercial and Industrial Efficiency Measures**

*David Jacobson, National Grid, Northborough, MA  
Eric N. Studer PE, DMI, Wellesley, MA*

## **ABSTRACT**

National Grid has been using the results of detailed impact evaluation studies to improve the reliability of energy studies conducted as part of its demand side management programs since these programs were started in the early 1990s. This paper presents a summary of some of the major lessons that have been learned over the past decade of evaluation work. The paper is intended to help inform implementation staff at other utilities that may be developing quality control policies for new or poorly performing programs. The quality control recommendations are broken down into two major categories. The first group is intended for personnel charged with implementation of rebate programs and is targeted at reducing errors in savings estimation. The second category is intended for program developers who determine program guidelines and measure eligibility criteria. While many of the suggestions may increase program costs, in the long run these improvements are likely to enhance program credibility with customers and regulators.

## SESSION 2A

### **DEMAND RESPONSE PROGRAMS: BETTER RESULTS THROUGH BETTER EVALUATION**

*Moderator: William P. Saxonis, New York State Department of Public Service*

#### PAPERS:

##### **A Methodology for Estimating Large Customer Demand Response Market Potential**

Charles Goldman, Nicole Hopper, Ranjit Bharvirkar, Lawrence Berkeley National Laboratory; Bernie Neenan and Peter Cappers, Utilipoint International

##### **Desperately Seeking Savings from Small Scale Demand Response: The California Experience**

Robert M Wirtshafter, Wirtshafter Associates, Inc.; Kathryn Parlin, West Hill Energy and Computing; David Hungerford, California Energy Commission; Kevin McKinley, San Diego Gas & Electric; and Rob Bordner, Energy Market Innovations, Inc.

##### **Participation of Demand Response Resources in ISO New England's Ancillary Service Markets**

Ken Agnew, Paula Ham-Su, KEMA Inc.; Robert Burke, ISO-New England

#### SESSION SUMMARY:

Demand response programs are playing an increasingly important role in electricity markets, especially as demand for electricity continues to rise. This session presents three papers that offer important insights for evaluators, program managers and policy makers.

Goldman et.al. recommend a methodology for estimating demand response potential for large, non-residential utility customers and demonstrate the methodology under various scenarios. The authors also provide insightful observations about the factors that influence demand response impacts.

Wirtshafter et. al. analyze California's "20/20 Program." In 2005, this program awarded \$67 million in rebates to residential and small commercial/industrial customers for reducing their 2005 summer electricity consumption by 20 percent as compared to their summer 2004 consumption. From an evaluation standpoint, the program presented many challenges including the fact that customers were not required to enroll in the program. One of the many fascinating results of the evaluation is that about 75 percent of the rebate dollars were awarded to consumers not actively seeking to save energy in response to the program.

Agnew et.al. examine both the potential and challenges of incorporating demand response resources into the ancillary service markets. Ancillary service provides the on-call, short term relief that maintains system supply in the event of a loss of generation or transmission resources. While the evaluation data is preliminary, results from the Demand Response Reserve Pilot Program at ISO-New England suggest that demand response can be a viable component in the ancillary services market.

# **A Methodology for Estimating Large-Customer Demand Response Market Potential**

*Charles Goldman, Lawrence Berkeley National Laboratory (LBNL), Berkeley, CA*

*Nicole Hopper, LBNL, Berkeley, CA*

*Ranjit Bharvirkar, LBNL, Berkeley, CA*

*Bernie Neenan, Utilipoint International, Syracuse, NY*

*Peter Cappers, Utilipoint International, Syracuse, NY*

## **ABSTRACT**

Demand response (DR) is increasingly recognized as an essential ingredient to well-functioning electricity markets. DR market potential studies can answer questions about the amount of DR available in a given area and from which market segments. Several recent DR market potential studies have been conducted, most adapting techniques used to estimate energy-efficiency (EE) potential. In this scoping study, we: reviewed and categorized seven recent DR market potential studies; recommended a methodology for estimating DR market potential for large, non-residential utility customers that uses price elasticities to account for behavior and prices; compiled participation rates and elasticity values from six DR options offered to large customers in recent years, and demonstrated our recommended methodology with large customer market potential scenarios at an illustrative Northeastern utility. We observe that EE and DR have several important differences that argue for an elasticity approach for large-customer DR options that rely on customer-initiated response to prices, rather than the engineering approaches typical of EE potential studies. Base-case estimates suggest that offering DR options to large, non-residential customers results in 1-3% reductions in their class peak demand in response to prices or incentive payments of \$500/MWh. Participation rates (i.e., enrollment in voluntary DR programs or acceptance of default hourly pricing) have the greatest influence on DR impacts of all factors studied, yet are the least well understood. Elasticity refinements to reflect the impact of enabling technologies and response at high prices provide more accurate market potential estimates, particularly when arc elasticities (rather than substitution elasticities) are estimated.

# Desperately Seeking Savings from Small Scale Demand Response: The California Experience

*Robert M Wirtshafter, Wirtshafter Associates, Inc., Rydal, PA*  
*Kathryn Parlin, West Hill Energy and Computing, Chelsea, VT*  
*David Hungerford, California Energy Commission, Sacramento, CA*  
*Kevin McKinley, San Diego Gas & Electric, San Diego, CA*  
*Rob Bordner, Energy Market Innovations, Inc., Seattle, WA*

## Abstract

The Statewide California “20/20 Program” Demand Response Program was one of the biggest energy efficiency/demand response programs ever offered, with \$67 million in rebates given in 2005. The program offered customers an extra 20% reduction in their summer bills if they reduced their 2005 summer use by 20% as compared to their 2004 summer use. There was widespread promotion of the program by all three investor owned utilities. 885,000 households, representing 11% of the eligible households received rebates in 2005. Participants receiving rebates reduced their 2005 summer use by 1,184 GWh as compared to their 2004 summer use.

The unique challenge of this evaluation was measuring the awareness of the program and the potential incentive, the intent to participate, and the type of actions performed. With no enrollment process, all customers had the opportunity to participate, but only those who knew about the program and actively engaged in energy reduction activities could reasonably be considered to be participants. Consequently, the customer surveys conducted to assess the awareness and motivation of the utilities’ customers formed the foundation of our evaluation. To estimate program savings, two types of adjustments were made to the 1,185 GWh savings estimate:

1. Decreased savings to account for the fact that some of the total reduction in energy use was incidental to the program and cannot be reasonably attributed to the program efforts.
2. Increased savings to capture legitimate reduction in energy use resulting from participants who tried to reach the 20% reduction but were ultimately unsuccessful.

The results indicate that almost 75% of the rebate dollars paid were to households that were not aware of 20/20 or were not actively trying to save energy in response to the program.

# **Participation of Demand Response Resources in ISO New England's Ancillary Service Markets**

*Ken Agnew, KEMA Inc., Madison WI  
Robert Burke, ISO-New England, Holyoke MA  
Paula Ham-Su, KEMA Inc., Madison WI*

## **Abstract**

The participation of demand response resources in Ancillary Service Markets (ASM) is a recent development. Proponents characterize this new opportunity as a win-win situation for both the Independent System Operators (ISO) and demand response (DR) resources. Others question whether smaller DR resources will choose to participate given technology requirements and whether they can successfully deliver on commitments to the ISO. This paper addresses these questions using data from the evaluation of the Demand Response Reserves Pilot Program (DRRP) at ISO New England. First, we provide a brief background on the Ancillary Service Market. We describe the roles of the market and of traditional generation. Second, we introduce the ISO New England's Demand Response Reserves Pilot. This includes: (a) a brief outline of the program structure including: data requirements, the Internet Based Communication System Open Solution (IBCS OS), and program incentives, and (b) summary descriptions about the assets enrolled in the DRRP. Third, we describe the evaluation tools that were designed for this program. These tools range from event-specific reports produced shortly after each event to customer logs and surveys. Last, we provide findings from the October 2006 – May 2007 performance period. These findings include a range of asset load relief performance metrics as well as metrics associated with delivery of the program. These findings motivate preliminary conclusions with regards to the potential for DR in the Ancillary Service Market.



## SESSION 2B

### ESTABLISHING BENCHMARKS AND CONDUCTING BASELINE STUDIES

*Moderator: Dave Weber, NSTAR Electric & Gas*

#### PAPERS:

#### **Benchmarking and Best Practices in Power Management of Computers and Other Plug-Loads on Campus**

Carol Sabo, PA Consulting Group  
Susan Andrews, NYSERDA  
Lark Lee, PA Consulting Group  
Kimberly Bakalars, PA Consulting Group

#### **Innovative Lighting Baseline Hours-of-Use Research in Primary and Secondary Schools**

Dan Barbieri, RLW Analytics  
Paul Gray, Sr., United Illuminating

#### **You've Decided You Need A New Baseline Study – Now What?**

#### **Energy Star<sup>®</sup> Homes Baseline Studies: Challenges and Solutions**

Dorothy Conant, Independent Consultant  
William Blake, National Grid  
Stephen Bonanno, NSTAR Electric & Gas  
Bruce Harley, Conservation Services Group  
Lynn Hoefgen, Nexus Market Research  
Joe Swift, Western Massachusetts Electric  
Lisa Wilson-Wright, Nexus Market Research

#### SESSION SUMMARY:

This session focuses on the challenges associated with successfully developing and updating baselines and benchmarks for accurate measurement of energy savings. The papers stress the importance of careful planning and provide practitioners with useful lessons learned.

The first paper, *“Benchmarking and Best Practices in Power Management of Computers and Other Plug-Loads on Campus”*, describes an approach used to determine plug-load electric use and energy efficiency opportunities on college campuses. The authors apply their five years of experience in collecting and analyzing data to benchmark existing conditions against best practices for a variety of plug-load equipment. Given the large differences among colleges, the objective has been to identify indicators that are easy to calculate and compare across similar educational facilities. In addition, the project team has identified examples of policies, procedures and programs that represent best practices.

The second paper, *“Innovative Lighting Baseline Hours-of-Use Research in Primary and Secondary Schools”*, sought to update and refine estimates of annual operating hours and the potential savings for occupancy sensors. The authors employed an ambitious sampling and monitoring plan to address a number of dimensions of lighting usage. The importance and pitfalls of fundamental assumptions and reliance on standard analytical techniques are discussed. Successful completion of the project, including a number of interesting and useful findings, required persistent efforts to find alternative and simpler methodological approaches.

The third paper, “*You’ve Decided You Need A New Baseline Study – Now What? Energy Star® Homes Baseline Studies: Challenges and Solutions*”, addresses the need to update program baselines to reflect changes in building practice and energy consuming systems. The authors discuss an approach taken to minimize the introduction of bias in sample selection, as well as documenting unforeseen evidence of possible bias. A homeowner survey conducted at the time of data collection emphasizes the continuing issue of lack of awareness and understanding among consumers regarding energy efficient construction and equipment.

# **Benchmarking and Best Practices in Power Management of Computers and Other Plug-Loads on Campus**

*Carol Sabo, PA Consulting Group, Arlington, VA*

*Susan Andrews, New York State Energy Research and Development Authority (NYSERDA), Albany, NY*

*Lark Lee, PA Consulting Group*

*Kimberly Bakalars, PA Consulting Group*

## **Abstract**

Recognizing the impact of the growing plug-load energy consumption, the New York State Energy Research and Development Authority (NYSERDA) has funded the **Energy \$mart<sup>SM</sup>** Offices program for the past 6 years to promote energy-efficiency measures, policies, activities, and education to reduce plug-load electric costs in offices, on campuses, and for school districts. At the same time, the State University of New York (SUNY) Energy Procurement group is also working with the Chancellor's Office in developing a strategic plan that includes reducing energy consumption on SUNY campuses. This plan encourages participation in the NYSEERDA program as a quick turnaround, low-cost approach to reduce plug-load electric use on campus.

The NYSEERDA program is unique in that it takes a comprehensive approach to plug-load equipment energy use in looking at business and non-business equipment. In addition, the program is the first to collect and use on-site plug-load equipment surveys and interviews to establish benchmarks that identify standard practice and best practices for college campuses to encourage plug-load efficiency.

The paper will describe the approach used to determine plug-load electric use and energy-efficiency opportunities on college campuses and then present the results of the benchmarking of best practices in plug-load efficiency. The intent is to encourage colleges and universities to adopt these best practices in reducing the fast growing plug-load electric costs on campus.

# **Innovative Lighting Baseline Hours-of-Use Research in Primary and Secondary Schools**

*Dan Barbieri, Engineering Manager, RLW Analytics, Inc.*

*Paul Gray, Sr. Business Development Professional, The United Illuminating Company*

## **Abstract**

Some efficiency programs base their estimates of lighting savings in schools upon hours-of-use that reflect traditional, seasonal occupancy for educational, athletic, and occasional dance functions. But with more communities utilizing school buildings year-round for community events and adult education, some hypothesize that current program savings assumptions do not capture this increased use and hence underestimate measure impacts.

Recently, several electric utilities in Connecticut and Massachusetts sponsored a study to better inform lighting hours *prior to sensor installation* in the interest of more accurately estimating the impact of occupancy sensors on lighting. The utilities sought credible estimates of these “baseline” lighting operating hours in school buildings by a variety of dimensions of interest including school classification, demographics, and room type. In addition to reassessing the value of occupancy sensors in schools, this research also pursued hourly lighting profiles and peak coincidence factors.

The scope of this project proved to be extensive and challenging, employing statistical sampling and data collection techniques in a creative and robust analytical framework. Engineers performed a complete lighting inventory of every room in 80 schools and logged occupancy and lighting hours in 646 rooms across both summer and fall-session periods. In total, analysts processed over one million records of lighting/occupancy data in a complex analysis that combined interview-based and measured hours with room-level detail and school-level characteristics.

This paper highlights some innovative methods while sharing study results. This two-year project offers valuable lessons on how to 1) plan and leverage multi-dimensional data collection and 2) salvage an analysis when assumptions fail.

# **You've Decided You Need A New Baseline Study—Now What? ENERGY STAR® Homes Baseline Studies: Challenges and Solutions**

*Dorothy Conant, Independent Consultant, Hudson, MA  
William Blake, National Grid, Northborough, MA  
Stephen Bonanno, NSTAR Electric and Gas, Westwood, MA  
Bruce Harley, Conservation Services Group, Westborough, MA  
Lynn Hoefgen, Nexus Market Research, Inc., Cambridge, MA  
Joe Swift, Western Massachusetts Electric, Springfield, MA  
Lisa Wilson-Wright, Nexus Market Research, Inc., Cambridge, MA*

## **Abstract**

Is a new residential construction baseline study needed? Where to start? How will the results be used? How much money to spend? What data do you want? What data do you need? How do you draw your sample? How large should your sample be? Should ENERGY STAR homes be excluded?

Sampling bias is a major issue for all baseline studies. It is impossible to account for all potentially confounding variables in a sample design, but it is important to learn from what others have done and exert your best effort to account for the most significant variables in order to minimize their destructive influence and maximize the validity of results. A well thought out sampling design will not ensure an unbiased sample and may, as was the case in the Massachusetts baseline study, uncover bias issues not considered or addressed in previous studies.

Without a census sample no baseline study can provide perfect results. The key to designing and conducting a good baseline study is taking proactive steps to avoid problems encountered in other studies; concentrating on collecting the information program planners, implementers and evaluators need; and addressing any known bias issues in applying the results. By taking these steps the Massachusetts study produced valuable information on how construction practices have changed over the past four years that could be used to update baseline home construction practice assumptions used in calculating program savings

## SESSION 2C

### EVALUATING ENERGY EFFICIENCY PROGRAMS IN THE LOW-INCOME SECTOR

*Moderator: Martin Kushler, ACEEE*

#### PAPERS:

##### **Design of the National Impact Evaluation for the DOE Weatherization Assistance Program**

Mark P. Ternes, Oak Ridge National Laboratory  
Martin Schweitzer, Oak Ridge National Laboratory  
Richard Schmoyer, Oak Ridge National Laboratory  
Bruce Tonn, Oak Ridge National Laboratory  
Joel F. Eisenberg, Oak Ridge National Laboratory

##### **Estimating the Energy Savings Potential Available from California's Low-Income Population**

Kathleen Gaffney, KEMA Inc.  
Fred Coito, KEMA Inc.

##### **Impact of Flipping the Switch: Evaluating the Effectiveness of Low-Income Residential Energy Education Programs**

Anne West, Quantec LLC  
Jamie Drakos, Quantec LLC  
M. Sami Khawaja, Quantec LLC

#### SESSION SUMMARY

This session addresses three very distinct and timely subjects relating to energy efficiency programs for the low-income sector: the design of the forthcoming national Weatherization evaluation; results of a California low-income energy efficiency potential study; and a comparison of evaluations of low-income energy education programs.

The first paper, "Design of the National Impact Evaluation for the DOE Weatherization Assistance Program", focuses on the new forthcoming national evaluation of the DOE Weatherization Program, being planned by Oak Ridge National Laboratory. This extensive research effort is of considerable interest because it will be the first comprehensive national evaluation of the Weatherization Program since the early 1990's. This paper describes the proposed evaluation approach in some detail, and should be of interest both to those involved with low-income energy efficiency programs as well as those who appreciate the complexities of undertaking a large-scale, comprehensive national evaluation.

The second paper, "Estimating the Energy Savings Potential Available from California's Low-Income Population", presents the results of the first-ever comprehensive statewide needs assessment of the low-income population in California. The research features a 'bottom-up' approach, using detailed assessments of energy efficiency measure applicability and need, based on over 1,500 onsite surveys throughout the state. This paper should be of interest both for the specific results obtained, as well as the methodological approach employed.

The third paper, "Impact of Flipping the Switch: Evaluating the Effectiveness of Low-Income Residential Energy Education Programs", focuses on an important but traditionally neglected area: evaluating the impact results of programs featuring energy education and the distribution of "low-cost" energy efficiency measures. These types of programs are very popular with both government and utility-funded low-income service efforts, but traditionally have not received much in the way of serious impact evaluation. This paper discusses methodological approaches and challenges associated with

evaluating these types of programs, reviews results from a number of recent (post-2000) evaluations, and provides the authors' conclusions regarding energy education "best practices".

## **Design of the National Impact Evaluation for the DOE Weatherization Assistance Program**

*Mark P. Ternes, Oak Ridge National Laboratory, Oak Ridge, TN*  
*Martin Schweitzer, Oak Ridge National Laboratory, Oak Ridge, TN*  
*Richard Schmoyer, Oak Ridge National Laboratory, Oak Ridge, TN*  
*Bruce Tonn, Oak Ridge National Laboratory, Oak Ridge, TN*  
*Joel F. Eisenberg, Oak Ridge National Laboratory, Washington, DC*

### **Abstract**

The U.S. Department of Energy is undertaking a new national evaluation of its Weatherization Assistance Program. Following the evaluation plan developed by the Oak Ridge National Laboratory, four studies will be performed to evaluate the Program as it was implemented in PY 2006: an impact assessment, a process assessment, special technical studies, and a synthesis study. This paper describes how the evaluation's research questions were identified and discusses the plans for implementing the impact assessment and special technical studies.



# **Estimating the Energy Savings Potential Available from California's Low Income Population**

*Kathleen Gaffney and Fred Coito, KEMA Inc., Oakland, CA*

## **Abstract**

This paper presents the results of the energy savings potential analysis completed as part of the first-ever, comprehensive needs assessment conducted for California's low income population. The needs assessment was commissioned to direct future policy regarding the various low income energy programs offered in the state. The focus of this paper is on one of these programs: the Low Income Energy Efficiency (LIEE) Program, which installs weatherization and energy efficiency measures in qualified dwellings at no charge.

We begin with an introduction to the LIEE Program and present an overview of our data collection methodology. We then describe the energy use characteristics of California's low income population, and discuss the approach taken to determine the applicability of and need for various energy efficiency measures that have historically been offered through the LIEE Program. Next, we assess the total energy savings potential associated with these measures and determine the extent to which this potential is available based on an analysis of willingness to participate. The results from this assessment indicate that nearly 600 GWh and over 80 million therms of energy savings potential is available from California's low income population. These results have been used to direct future policy regarding the program design features, as well as provided input for future program goals and funding decisions.

**Impact of Flipping the Switch:  
Evaluating the Effectiveness of Low-Income Residential  
Energy Education Programs**

*Jamie Drakos, Quantec, LLC, Portland, OR  
M. Sami Khawaja, Ph.D., Quantec, LLC, Portland, OR  
Anne West, Quantec, LLC, Portland, OR*

**ABSTRACT**

Evaluations of different low-income energy education initiatives have revealed wide variability in energy savings. This paper utilizes data from a number of energy education programs to illustrate the evaluated energy savings. The paper includes a discussion of methods for and challenges of assessing impacts of energy education programs. Topics covered include the advantages and disadvantages of participant self-reporting, participant surveys, use of engineering algorithms to calculate savings, and billing analysis.

In addition, we describe best practices observed for low-income energy education programs, which are applicable to both programs offered in conjunction with other programs and those offered on a stand-alone basis. Finally, to assess effectiveness of different approaches, we map educational strategies to program outcomes.

## SESSION 2D

### THE ROLE OF ENERGY EFFICIENCY AND EVALUATION IN REDUCING GREENHOUSE GAS EMISSIONS

*Moderator: Edward Vine, Lawrence Berkeley National Laboratory & California Institute for Energy and Environment*

#### PANELISTS:

Steve Schiller, Schiller Consulting, Inc. & California Institute for Energy and Environment  
Bill Prindle, American Council for an Energy Efficient Economy  
Scott Bernstein, Center for Neighborhood Technology

#### SESSION SUMMARY:

The reduction of greenhouse gas emissions for mitigating climate change is being discussed at the international, regional, state, and local level – in the public sector as well as in the private sector. But what does this mean for energy efficiency and for evaluation? For many, energy efficiency is the first strategy that one should consider when trying to reduce emissions. But others are offering other solutions as their first choice. In particular, the following questions will be addressed:

- What are the opportunities and challenges in getting “energy efficiency” considered as the Number 1 Strategy for addressing climate change?
- What is the role of evaluation in making sure the emission reductions are credible, reliable, real, and measurable?

The panelists will provide some opening remarks, but this panel is designed to be informal and will emphasize discussion among panelists and the audience.

Steve Schiller will talk about US Climate Registeries and protocols, the latest activities in California on climate change, the National Action Plan for Energy Efficiency, the European Commission’s Energy Efficiency Initiative, and the UNFCCC Clean Development Mechanism (CDM).

Bill Prindle will talk about the Regional Greenhouse Gas Initiative (RGGI) that will include modeling results for energy efficiency’s impacts on energy prices, carbon allowance prices, customer bills, and regional economic indicators. He will discuss how the Memorandum of Understanding and the Model Rule handle efficiency, and the the RGGI states are addressing efficiency in their implementation proceedings. Finally, he will discuss the implications of the RGGI experience for other states and national climate policy.

Scott Bernstein will talk about the state of the art of local climate mitigation planning and evaluation, and present some case material of interest to the evaluation community. In particular, he will discuss the problems that he has seen in local government, such as measuring against an array of different baseline years, different ways of attributing emissions and considering lifecycles, and the lack of performance measures for benchmarking.

## SESSION 3A

### LESSONS LEARNED DURING THE LAST DECADE OF DEMAND RESPONSE PROGRAMS

*Moderator: Michael Messenger, California Energy Commission*

#### PAPERS:

##### **Want to Avoid Building a Large Power Plant? Top Ten Keys to Building a Successful Demand Response Programs**

Lark Lee and Carol Sabo, PA Consulting  
Ann Lieser and Heather Hemphill, Xcel Energy

##### **Beat the Heat with a Better Baseline**

Stephen Carlson, RLW Analytics, Middletown, CT  
Chad Telarico, RLW Analytics, Middletown, CT

##### **Communication Reliability Improvements through Measurement and Verification of Demand Response Programs**

Robert Bress, Comverge, Inc., East Hanover, NJ

#### SESSION SUMMARY:

This session will focus on the lessons learned from a set of evaluations of demand response programs conducted in Minnesota, New Jersey and the Mid West. At the highest level the key lessons are how you calculate the baseline for peak reduction payments really matters, targeting and taking care of customers is crucial to the effectiveness of demand response programs and the reliability of the channels you use to communicate with customers are likely to become increasingly important over the next decade.

The first paper, “Want to Avoid building a Large Power Plant? Top Ten Keys to Building a Successful Demand Response Programs”, is based on a comprehensive evaluation of XCEL ENERGY’s demand response program and a high level review of a number of different process and impact evaluations conducted on demand response programs from the North East and Mid West . The authors review the effectiveness of the XCEL energy program design and identify customer segments who consistently provide high levels of peak savings. . The evaluation also suggests changes in reward or payment structure for customers to ensure they are receiving fair value for the load reduction delivered. The authors then deduce several recommendations to build and operate better demand response programs. Highlights included:

- Clearly establish goals and objectives for the program- not just reduce peak demand
- Target, and limit, program recruitment to those customers who are solid performers
- Identify specific opportunities to cross-sell demand response programs with energy efficiency programs,
- Introduce customers to the concept of demand response programs through voluntary programs – ‘good fits’ can then graduate to higher reward, higher commitment programs,
- Assist customers to help identify ways to respond to control events that fit their operations.
- Make sure participants’ compensation is in-line with the value they provide to the company.

- Performance is greatly increased if more than one site employee is trained on how to pick up and respond to notification signals.

The second paper, “Beat the Heat with a Better Baseline”, chronicles the use of different techniques to estimate baseline conditions before curtailment requests are made in the New York ISO area and their impact on the estimated peak savings and payments to customers. The peak savings estimates derived using simple averaging processes to construct an average baseline for a given building are contrasted with other techniques used to “true up” or adjust the customer baseline load shape ( up or down) based on conditions at the site three to four hours before a curtailment call. The impact of using different analysis techniques to construct a customer baseline and subsequent estimates of peak savings is shown for actual building load shapes during curtailment events in the summer 2006 in New York. Results from the paper document the potential problems with the adoption of a rigid or fixed methodology to define the customer baseline in the absence of other contextual information during system emergencies. The study finds that scalar adjustments ( up or down) to average or baseline load shapes based on the weather or actual operating conditions in the building on the day of the call sound good in theory but can yield unreliable estimates of peak savings during emergencies. This is particularly true if customers begin making voluntary reductions starting early in the morning rather than waiting for the call in the afternoon. The author concludes that program administrators and or the curtailment service providers should be given the flexibility to use an alternative true up method rather than the adopted or default protocol or method to estimate peak savings if there is visual evidence that customers have used pre cooling or other significant changes in cooling strategies during extreme conditions. The key is to make sure everyone understands the criteria that will be used to define an emergency condition and the resulting flexibility in determining a new customer baseline.

The third paper, “Communication Reliability Improvements through Measurement and Verification of Demand Response Programs”, reviews several methods to assess the effectiveness of communication channels used to notify or directly control loads as part of a load management program. The analyses include advanced mapping and topographical software packages to understand geographic effects on communication reliability. These analyses involve testing message reception by time of day, using different paging transmitters, and conducting quality control checks of hardware equipment. Results from an analysis of the effectiveness of direct load control show how one utility was able to increase the effectiveness of its programs by focusing on the weak links in the communication channels. Results from paging simulations and power to site analyses are also used to identify areas where signal reception is weak and identify alternative pathways to reach customers with poor receptivity. The results highlight the importance of measuring the effectiveness of communication channels used in load management programs to accurately estimate the peak savings achieved and cost effectiveness of the program.

# **Want to Avoid Building a Large Power Plant? Top Ten Keys to (or “Attributes of”) a Successful Demand Response Programs**

*Lark Lee and Carol Sabo, PA Consulting  
Ann Lieser and Heather Hemphill, Xcel Energy*

## **ABSTRACT**

In the Summer of 2006, regions throughout the US experienced new highs in peak demand. In fact, many regions reached demand levels that were not forecasted to occur for several more years. Yet some power systems were able to meet this tough challenge to successfully manage their grid under extreme stress more effectively than others because they had well-designed demand response programs. How can utilities optimize the performance of their demand response programs to best meet future peak demand needs? In 2005-06, Xcel Energy hired PA Consulting Group to conduct a process evaluation of their Minnesota Commercial and Industrial (C&I) Peak Load Control Program, a customer-driven demand reduction program. This paper highlights the results of this evaluation to provide “Top Ten” considerations for effective demand response programs.

## **Beat the Heat with a Better Baseline**

*Stephen Carlson, RLW Analytics, Middletown, CT*

*Chad Telarico, RLW Analytics, Middletown, CT*

### **Abstract**

Demand Response (DR) performance is evaluated using interval data to develop a baseline using a standard set of parameters that typically includes some type of N-day Average to determine the average shape of the load profile and a true-up period that is used to move the profile up or down to match the actual usage during a specified time period prior to the start of an event. These verification protocols are typically rigidly defined by the entity administrating the DR program and applied to all customers participating in the program regardless of the accuracy of the results.

This paper will examine what happens to these baselines in the real world when extreme electrical emergencies occur or customer's initiate curtailments early or employ strategies that drastically alter their typical load profiles. We will examine the effectiveness of making minor alterations to the existing baseline calculations to develop a custom baseline that more accurately evaluates performance. The custom baseline requires more time and expertise, yet the result is a fairer representation of the demand reduction and energy savings.

It is important for the demand response asset to be fairly evaluated and appropriately compensated for their performance during events. Rigidly applying a pre-defined standard verification protocol, when situations occur as described above, will often result in the participating assets not receiving credit for their full performance. The risk is real that customers that have their performance consistently under estimated will become dissatisfied and drop out of the demand response program to the detriment of us all.

# **Communication Reliability Improvements through Measurement and Verification of Demand Response Programs**

*Robert Bress, Comverge, Inc., East Hanover, NJ*

## **Abstract**

Measurement and Verification (M&V) processes and tools are the means for assessing the effectiveness of demand response programs. These processes and tools are continually adapted to extract greater information from M&V data. M&V analysis for demand response programs involves much more than simply analyzing load profile data. Load profile data analysis does yield insight into the load usage in the sample however it is also important to understand the communication networks used to communicate to devices in the field. In order to make accurate estimates of curtailed load, we must also be able to estimate the reliability of the curtailment message reception. This paper details the analyses and methods used to improve the communication of demand response or curtailment signals in order to maximize load reduction results. This paper focuses on four areas of analysis used to improve communication reliability and therefore load reduction results. First, communication studies include tests of the paging system over time to look for intermittent communications, hardware malfunctions or other anomalous data. Geographic analysis uses maps to determine if there are any geographic dependencies in the communication system. External antenna deployment studies seek to improve communication in intermittent areas while maintaining a balance between the M&V sample and the population at large. Finally, paging simulations and tower to site profile analyses aid in planning new projects and taking a detailed look at poor communicating sites. In coordination, these methodologies have improved year to year reception performance by as much as 10%.



## SESSION 3B

### INTERNATIONAL DIMENSIONS: EVALUATING MULTIPLE MARKETS & MEASURES

*Moderator: Iris M. Sulyma, Power Smart, BC Hydro*

#### PAPERS:

##### **Assessment of White Certificate Schemes and Their Energy Savings Evaluation Methods**

Paolo Bertoldi, European Commission DG JRC, Institute for Environmental Sustainability, Ispra, Italy

Silvia Rezessy, Central European University, Budapest Hungary

##### **Developing a Process for Harmonised Bottom-Up Evaluations in European Union Member States**

Harry H.J. Vreuls, SenterNovem, The Netherlands

Jean-Sébastien Broc, Ecole des Mines de Nantes, France

Stefan Thomas, Wuppertal Institute for Climate, Environment and Energy, Germany

##### **How Do We Measure Resident's Benefits? Benefits and Costs Through Energy Savings Activities**

Tsuyoshi Ueno, Central Research Institute of Electric Power, Tokyo, Japan

Yukio Nakano, Central Research Institute of Electric Power, Tokyo, Japan

#### SESSION SUMMARY:

This session will focus on emerging evaluation approaches and strategies for initiatives targeting multiple market segments (consumers, commercial, industrial and transportation sectors), multiple markets (countries and/or regions) and/or multiple energy efficiency measures, programs or services. The relationship between form and function, the role of evaluation, the key evaluation elements required, the process of developing frameworks and other insights are very relevant given the emerging need to integrate energy efficiency evaluation with related initiatives such as demand response, climate change and renewable energy.

Paulo Bertoldi addresses an emerging market-based policy instrument, tradable white certificates, to foster energy efficiency improvements within the European Union. He assesses and discusses key design and operational features of the white certificate schemes in Great Britain, Italy & France and schemes emerging in Europe. These schemes are based on quantified energy savings obligations imposed on energy distributors and suppliers, coupled with certification of the energy savings (white certificates) and the possibility to trade certificates. He explains the role of monitoring and evaluation in the certification process and the process for assessing achievement of energy savings goals.

Harry Vreuls provides detailed information regarding the development of the monitoring and evaluation systems for European Union Member States. The emerging system addresses single programs, services and measures, as well as methods for monitoring the overall impact of measures implemented in a country/region, including white certificate schemes. The main elements of the project to develop the harmonised framework are presented, including descriptions of the process for developing the framework, the bottom-up evaluation methods developed, and the plans to develop harmonised default values and benchmarks.

Tsuyoshi Ueno describes an approach to determining which energy savings activities (consumer behaviours) are both effective at decreasing energy consumption and that also maximize the comfort and convenience of consumers. He uses an analytic hierarchy process, a mathematical technique for estimating the relative effectiveness of various factors in a decision making process using pair-wise

comparisons. The model identifies which energy savings activities should be adopted first in terms for four evaluation criteria (convenience, environmental benefit, comfort, and cost) and allows calculation or energy savings potential when combined with pre-existing meter data.

# **Assessment of White Certificate Schemes and their Energy Saving Evaluation Methods**

*Paolo Bertoldi, European Commission DG JRC, Institute for Environment and Sustainability, Ispra, Italy*

*Silvia, Rezessy, Central European University, Budapest, Hungary*

## **Abstract**

Recently a number of countries have introduced market-based instruments to foster energy efficiency improvements. Some of these schemes are based on quantified energy savings obligations imposed on energy distributors or suppliers, coupled with a certification of the energy savings (via white certificates), and a possibility to trade certificates. The paper presents an up-to-date review of white certificate schemes in Europe, and analyses results achieved so far. It discusses design and operational features that are key to achieve the overall saving targets. Delineation of the scheme in terms of eligible projects, technologies and obliged parties, institutional structure and processes to support the scheme are among the issues discussed. Energy saving evaluation methods are central to the present discussion.

# Developing a Process For Harmonised Bottom-Up Evaluations in European Union Member States

*Harry H.J. Vreuls, SenterNovem, The Netherlands*

*Jean-Sébastien Broc, Ecole des Mines de Nantes, France*

*Stefan Thomas, Wuppertal Institute for Climate, Environment and Energy, Germany*

## **Abstract**

The new EU Directive on energy end-use efficiency and energy services (2006) stimulates the thinking in the Member States about how they could evaluate the energy savings from energy efficiency programs and energy services in order to contribute to achieving the target of 9 % energy savings in the ninth year. Late 2006 the European commission started a three year project (EMEEES) that includes the development of such concrete methods (combination of bottom-up and top-down).

This paper holds the intermediate results. The analysis of good practices in EU evaluations -to be finalized by summer 2007 – are based on methods and results from detailed evaluation studies as well as the simplified ex-ante methods like those for the obligation/white certificate systems in several countries.

The work on EU harmonised bottom-up evaluation methods (the second main element of the project) is organized in three steps. The *process* for developing a harmonised bottom-up evaluation method; concrete bottom-up evaluation *methods* for 20 end-use technologies, policy instruments and/or energy services types; and a set of *harmonised default values and benchmarks* for specified years. A specific topic is the acceptance by the Member States of harmonised bottom-up evaluation methods and the definitions of key values needed for a certain method: either for all Member States, or specific for each Member State but in a consistent way; ex ante or ex post - and how they should be used. We also present a draft structure for the MS progress report to the European Commission by mid 2011.

# **How Do We Measure Resident's Benefits? Benefits and Costs through Energy-Saving Activities**

*Dr. Tsuyoshi Ueno, Central Research Institute of Electric Power Industry, Tokyo, JAPAN*

*Dr. Yukio Nakano, Central Research Institute of Electric Power Industry, Tokyo, JAPAN*

## **ABSTRACT**

The energy-saving activities of household members such as disconnecting appliances from the outlet to reduce standby power and adjusting the settings of the cooling temperature of air conditioners are some important methods of reducing energy demand. However, when people try to conserve energy or are encouraged to conserve energy, they generally choose a balance between the benefits and costs that they reap through energy-saving activities. However, people do not necessarily maintain energy-saving activities that reduce their comfort notably. Moreover, people may adopt energy-saving activities that do not reduce energy at all.

To determine energy savings activities that are both effective at decreasing energy consumption and that also maximize the comfort and convenience of consumers an analytic hierarchy process (AHP) was used. AHP is a mathematical technique for estimating the relative importance or effectiveness of various factors in a decision making process using pair-wise comparisons. In this case, energy-saving activities, along with their benefits and costs were classified and presented to residential consumers. The benefits included energy reduction and cost reduction. On the other hand, costs included a user's labor and a reduction in the benefits expected through the use of appliances. The model identifies which energy savings activities should be adopted first in a household, based four evaluation criteria (convenience, environmental benefit, comfort, cost). In addition, the energy-saving potential that can be achieved when people carry out energy-saving activities was calculated based on monitored data and existing literature.

## SESSION 3C

### MARKETING AND PERFORMANCE ISSUES IN ENERGY EFFICIENT HOME PROGRAMS

*Moderator: Ben Bronfman, Quantec. LLC*

#### PAPERS:

#### **ENERGY STAR® Homes and Green Building Programs: Can We Have a Successful Partnership?**

Betty M. Tolkin, Nexus Market Research, Inc.

William Blake, National Grid

Stephen Bonanno, NSTAR Electric and Gas

Lynn Hoefgen, Nexus Market Research, Inc.

Dorothy Conant, Independent Consultant

#### **New ENERGY STAR® Homes Requirements: Is It Harder To Recruit And Keep Builders**

Dorothy Conant, Independent Consultant, Hudson, MA

William Blake, National Grid, Northborough, MA

Stephen Bonanno, NSTAR Electric and Gas, Westwood, MA

Betty Tolkin, Nexus Market Research, Inc., Cambridge, MA

#### **Cracking the Code for Residential New Construction: Using End-Use Metered Data to Revise Energy Estimates of Compliance Models**

Clark Bernier, RLW Analytics

Jarred Metoyer, RLW Analytics

#### **Putting Codes Into Action: How Newly Updated Building Codes Translate Into Practice**

Michelle Levy, Quantec, LLC, Portland, OR

M. Sami Khawaja, Quantec, LLC, Portland, OR

Lynn Benningfield, The Benningfield Group, Folsom, CA

#### SESSION SUMMARY:

This session will focus on the challenges associated with the implementation, performance and code compliance associated with residential new construction. This session will focus on the lessons learned from a set of evaluations of conducted in New England, California, and a sample of state programs across the country.

The first paper, “ENERGY STAR® Homes and Green Building Programs: Can We Have a Successful Partnership?”, reports on an evaluation of the 2006 evaluation of the Massachusetts ENERGY STAR® Homes Program, for the first time, specifically addressed the relationship between ENERGY STAR® Homes program participation and green building through interviews with 40 builders and eight multifamily project developers and a telephone survey of 200 new home buyers.

The study concludes that the opportunity for Green building programs have much to gain by working with ENERGY STAR® Homes Programs. Emphasizing energy efficiency and the resulting savings on energy bills will attract larger numbers of consumers and builders that will allow these programs to become more of a mainstream factor in new home construction. While it is important to remember that while more home buyers are familiar with green building than with ENERGY STAR® Homes, the vast majority also consider energy efficiency to be part of the former.

The second paper, “New ENERGY STAR® Homes Requirements: Is It Harder to Recruit and Keep Builders,” examines issues associated with one of the biggest challenges facing ENERGY STAR® Homes programs: convincing builders to participate, especially under the new, stricter EPA requirements for ENERGY STAR® certification. This is especially true in markets where builders believe they are already building energy-efficient homes; most builders, at least until the current slowdown in the housing market, have not had any problem selling their homes; and consumers are not demanding more energy-efficient homes.

The authors spoke with over 10 state and regional program managers, as well as participating and non-participating builders and concluded that while there are difficulties in maintaining builder interest, there are several strategies for maintaining builder interest. Among them are adding participation paths; providing training on duct sealing and/or air infiltration; encouraging builders to install ducts in conditioned space to avoid the need for duct testing; and encouraging the use of better insulation materials. Going forward, several programs are considering adding green building, solar, and/or renewable program components to provide builders with more ways to differentiate their homes from their competitors’ homes. In addition, some programs have introduced incentives for builders whose homes either fail to meet ENERGY STAR® requirements or who are not interested in trying to meet all the requirements for ENERGY STAR® certification.

The third paper, “Cracking the Code for Residential New Construction: Using End-Use Metered Data to Revise Energy Estimates of Compliance Models,” examines the reliability of the primary code compliance model used in California for the 2002-03 and 2004-05 California Energy Star® Homes programs. The authors conducted extensive end-use metering of cooling, heating, and water heating energy usage of 101 single family and 99 multi family units. These data were used to adjust the site usage estimates obtained from the compliance models to more accurately reflect the energy consumption of the three program-impacted end uses (cooling, heating, and water heating) in the participant homes.

Results showed the compliance models over-predicted usage by 25-70% for single family homes, depending on the end use. The authors present several recommendations for modifying the compliance tool, but suggest that it might be simpler to accept that while compliance models are useful for relative applications such as performance-based compliance or relative-performance-based program participation, they may not be the best tools for estimating energy usage.

The final paper in this session, “Putting Codes Into Action: How Newly Updated Building Codes Translate Into Practice,” describes the methods employed and empirical findings from one study aimed at quantifying non-compliance rates for a sample of newly codified (and newly code-updated) building measures in California.

This study found a range of noncompliance rates, from 28% ( $\pm$  3%) for residential hardwired lighting to 100% ( $\pm$  1%) for the duct testing requirement for new nonresidential buildings. Qualitatively, the study yielded lessons on the research process; for example, building permit data were often found to be incomplete, and compliance criteria were often partially – but not fully – met, raising important questions about the appropriateness of awarding “partial credit,” and if so, the appropriate level.

The authors conclude that noncompliance rates in California are idiosyncratic and highly measure-dependent. The diversity of processes and procedures employed at California building departments, a lack of training among counter permit technicians, and the range of levels of requirements in the codes themselves all contribute to the variation of observed noncompliance rates.

# **ENERGY STAR® Homes and Green Building Programs: Can We Have a Successful Partnership?**

*Betty M. Tolkin, Nexus Market Research, Inc.*

*William Blake, National Grid*

*Stephen Bonanno, NSTAR Electric and Gas*

*Lynn Hoefgen, Nexus Market Research, Inc.*

*Dorothy Conant, Independent Consultant*

## **ABSTRACT**

Concerns about global warming as well as rising energy prices have led to a proliferation of “green building” initiatives and programs aimed at the market for residential new construction. Green building may encompass energy efficiency, the use of renewable energy sources, water efficiency, site selection to minimize the use of undeveloped land, locating near public transportation to minimize car use, smaller or “right-sized” homes, and use of renewable or recycled materials. Since energy efficiency is one part of green building, some programs will overlap with local ENERGY STAR Homes programs and target the same builders. The 2006 evaluation of the Massachusetts ENERGY STAR Homes Program, for the first time, specifically addressed the relationship between ENERGY STAR Homes program participation and green building through interviews with 40 builders and eight multifamily project developers and a telephone survey of 200 new home buyers.

Finally, the evaluation also explored opportunities for interaction between ENERGY STAR Homes and green building programs through interviews with ten ENERGY STAR Homes program sponsors across the country recounting successes in working together, an example being co-sponsorship of the LEED for Homes pilot. Some also noted pitfalls in partnerships, such as an ENERGY STAR sponsor speaking of “green washing”—that is, green building programs claiming energy savings and better indoor environments in the absence of verification of air tightness and ventilation requirements.

The research conducted has led to the conclusion that the popularity of green building presents a unique opportunity for ENERGY STAR Homes Programs to work with green building programs to ensure that energy efficiency, specifically ENERGY STAR standards, become prerequisites for building green.



## **New ENERGY STAR<sup>®</sup> Homes Requirements: Is It Harder To Recruit And Keep Builders**

*Dorothy Conant, Independent Consultant, Hudson, MA*  
*William Blake, National Grid, Northborough, MA*  
*Stephen Bonanno, NSTAR Electric and Gas, Westwood, MA*  
*Betty Tolkin, Nexus Market Research, Inc., Cambridge, MA*

### **Abstract**

ENERGY STAR Homes Programs across the country vary considerably in the level of financial incentives offered, the expenses participating builders are expected to pay, marketing strategies and market penetration. However, they all say that one of their biggest challenges is convincing builders to participate, especially under the new, stricter EPA requirements for ENERGY STAR certification. This is especially true in markets where builders believe they are already building energy-efficient homes; most builders, at least until the current slowdown in the housing market, have not had any problem selling their homes; and consumers are not demanding more energy-efficient homes.

Steps programs are taking to make their programs more attractive to builders include adding participation paths; providing training on duct sealing and/or air infiltration; encouraging builders to install ducts in conditioned space to avoid the need for duct testing; and encouraging the use of better insulation materials. Going forward, several programs are considering adding green building, solar, and/or renewable program components to provide builders with more ways to differentiate their homes from their competitors' homes. In addition, some programs have introduced incentives for builders whose homes either fail to meet ENERGY STAR requirements or who are not interested in trying to meet all the requirements for ENERGY STAR certification.

# **Cracking the Code for Residential New Construction: Using End-Use Metered Data to Revise Energy Estimates of Compliance Models**

*Clark Bernier, RLW Analytics  
Jarred Metoyer, RLW Analytics*

## **Abstract**

To qualify for the 2002-03 and 2004-05 California Energy Star<sup>®</sup> Homes programs, a home has to have an annual energy consumption 15-20% below code baseline as estimated by its code compliance model. Because the results of these model runs are collected from the entire program population, they would be invaluable tools for obtaining extremely accurate estimates of program savings if they are accurate. However, the models are based on a number of assumptions about consumer behavior and environment that may or may not hold true in practice.

As part of the evaluation for the 2004-05 program, we conducted extensive end-use metering of cooling, heating, and water heating energy usage of 101 single family and 99 multi family units. These data were used to adjust the site usage estimates obtained from the compliance models to more accurately reflect the energy consumption of the three program-impacted end uses (cooling, heating, and water heating) in the participant homes.

Our findings show that the compliance models are not accurate predictors of average annual energy usage. With the exception of single family homes in coastal climates, the models routinely over-predict the annual energy usage for all three program-affected end-uses. For single family homes, the models over-predicted usage by 25-70%, depending on end-use. Multifamily overestimates were much larger, though less statistically reliable. A number of possible explanations are offered for these results and possibilities for future studies are explored.

# Putting Codes Into Action: How Newly Updated Building Codes Translate Into Practice

*Michelle Levy, Quantec, LLC, Portland, OR*  
*M. Sami Khawaja, Quantec, LLC, Portland, OR*  
*Lynn Benningfield, The Benningfield Group, Folsom, CA*

## Abstract

Estimating energy savings from codes and standards programs is a complex undertaking. In addition to the quantification of expected savings resulting from an increase in code stringency, the approach must also account for the effect of pre-existing utility incentive programs, naturally occurring market trends, and non-compliance rates. This paper describes the methods employed and empirical findings from one study aimed at quantifying non-compliance rates for a sample of newly codified (and newly code-updated) building measures in California.

We looked at seven building measures in both the residential and nonresidential sectors to learn how closely actual building practices adhere to newly adopted codes. Data were collected by reviewing permits and conducting verification site visits for a sample of building projects throughout the state. Key findings from this study include quantitative estimates of noncompliance rates for the seven measures, as well as qualitative information about some unexpected complexities associated with data collection efforts around building practices, both at building departments (during permit review) and at building sites (during inspection).

This study found a range of noncompliance rates, from 28% ( $\pm 3\%$ ) for residential hardwired lighting to 100% ( $\pm 1\%$ ) for the duct testing requirement for new nonresidential buildings. Qualitatively, the study yielded lessons on the research process; for example, building permit data were often found to be incomplete, and compliance criteria were often partially – but not fully – met, raising important questions about the appropriateness of awarding “partial credit,” and if so, the appropriate level.

This paper is targeted at providing participants with the following: For utilities and designers of codes and standards programs, insight into realistic ex ante savings estimates with respect to noncompliance rates; for evaluators, important process lessons including how to effectively work with building departments and streamline data collection efforts.

## **SESSION 3D**

### **HOT TOPIC: BOOM TIMES IN THE EVALUATION PROFESSION THE GOOD, THE BAD AND THE UGLY**

*Moderator: Jim Mapp, Wisconsin Division of Energy*

#### **SESSION SUMMARY:**

This will be a panel discussion of all aspects of the booming evaluation profession, including The Good, The Bad and The Ugly. **THE GOOD**; there will be a brief review of the booming evaluation profession and a look ahead at new issues that will need to be incorporated into future evaluations such as proposed federal legislation and new energy initiatives at the state and local level. **THE BAD**; there will be a discussion of whether people are spread too thin as a consequence of the fact that we are in **BOOM TIMES**. **THE UGLY**; there is also an issue of whether business interests may be taking precedent over technical considerations and if responsibilities are being delegated too far down the organizational chain. We will discuss the role of mentoring and empowering employees.

We will conclude with what should be done to capitalize on the current boom for the long-term betterment of the evaluation profession?

## SESSION 4A

### **WORKING LIKE CLOCKWORK? EVALUATIONS OF TOU DEMAND RESPONSE PROGRAMS FROM ACROSS THE U.S.**

*Moderator: Jeremy Newberger, National Grid*

#### PAPERS:

#### **Residential Time-of-Use with Critical Peak Pricing Pilot Program – Comparing Customer Response and Demand Impacts of an Information-Only Program to a Technology-Assisted Program**

Jeff Erickson, Summit Blue Consulting, LLC  
Michael Ozog, Summit Blue Consulting, LLC  
Elaine Bryant, PSE&G  
Susan Ringhof, PSE&G

#### **New Paradigm, Same Players: The Relationship Between Reliability and Price-Responsive DR Program Participants in California**

Mike Ting, Itron, Inc.  
Amy Buege, Itron, Inc.  
Mike Rufo, Itron, Inc.

#### SESSION SUMMARY:

Time-of-use programs are gaining increasing prominence as utilities and grid operators look for ways to reduce demand at specific times to aid in managing price spikes and improving system reliability. There are many different kinds of TOU programs: targeting different market segments, requiring different levels of customer participation, offering different kinds of incentives, targeting various customer groups, employing different kinds of notification. While a specific TOU program is often tailored to meet the needs and characteristics of the specific system, much can be learned from the experience of others who have launched and evaluated TOU programs of their own.

The first paper discusses the experiences with a residential TOU pilot program in the eastern U.S. The basic TOU rate incorporated low, medium, and high-cost time periods as well as an extra high cost period, called the Critical Peak Price (CPP). The first segment in the pilot program tested how well customers would respond to TOU/CPP when given advance warning and educational information only. The second segment offered customers the same rate and advanced warning, but also provided customers with a free programmable thermostat that received price signals from the utility and could be programmed to adjust air conditioning set points in response to changes in the price signals. This paper compares the two segments on program recruitment issues, participant satisfaction, and demand impacts, as well as other factors.

Many TOU programs are developed to build on enrolling customers who were on pre-existing demand response or rate programs. The second paper presents the results of an in-depth analysis of the Demand Bidding Program (DBP) participant population in California with a focus on interruptible service customers enrolled in DBP. The investigation highlights two important but conflicting participation trends. First, a significant portion of reliability customers have adapted their curtailment planning and actions from the infrequent, compliance-driven framework of reliability programs to the more frequent, voluntary framework of price-responsive programs. However, the fact that a significant portion of participation in price-responsive programs is coming from existing reliability customers also

indicates that the level and growth of participation in price-responsive programs from customers who had not previously participated in any DR program is significantly less than it would otherwise appear.

# **Residential Time-of-Use with Critical Peak Pricing Pilot Program: Comparing Customer Response between Educate-Only and Technology-Assisted Pilot Segments**

*Jeff Erickson, Summit Blue Consulting, Verona, WI  
Michael Ozog, Summit Blue Consulting, Boulder, CO  
Elaine Bryant, Susan Ringhof, PSE&G*

## **Abstract**

In 2006 and 2007 PSE&G offered residential customers in two selected municipalities an opportunity to participate in a residential time-of-use (TOU) pilot program. The TOU rate incorporated fixed low, medium and high-cost time periods with an “extra high” cost period, called the “Critical Peak Price” (CPP) that was utilized on an as-needed basis. There were two TOU segments included in the pilot program. The first, myPower Sense, was designed to test how well customers would respond to TOU pricing and reduce demand during CPP events when given advance warning and educational information only. PSE&G used e-mail and telephone calls to notify participants the night before a CPP event. The second segment, myPower Connection, offered customers the same TOU/CPP rate and advanced warning of CPP events, but also provided customers with a free programmable thermostat that received price signals from PSE&G and could be programmed to adjust air conditioning set points in response changes in the TOU/CPP price signals.

The educate-only segment, myPower Sense, required participants to take explicit self-imposed actions on peak price days (or else pay a significant price). The technology-enabled segment, myPower Connection, should, in theory, have produced greater demand reduction from customers, since they had the ability to pre-program their thermostat to automatically respond to higher priced time periods.

This paper compares the two segments on program recruitment issues, participant satisfaction, and demand impacts, as well as other factors.

# **New Paradigm, Same Players: the Relationship between Reliability and Price-Responsive Demand Response Program Participants in California**

*Mike Ting, Amy Buege, and Mike Rufo  
Itron, Inc. Consulting and Analysis Services Group, Oakland, CA*

## **Abstract**

This paper presents the results of an in-depth analysis of the Demand Bidding Program (DBP) participant population in California with a focus on interruptible service customers enrolled in DBP and how their participation influences the outlook for growth in price-responsive demand response (DR) from DBP going forward. Based on results from participation tracking, bidding, load reduction impact, and process analyses, we found that while interruptible customers account for a rather small share of customers enrolled in DBP, they account for significant share of enrolled non-coincident peak load and an even larger share of the load reductions bid by DBP participants during DBP events. In the end, interruptible customers accounted for the majority of total load reductions realized through California's statewide DBP programs in 2005. These findings indicate two important but conflicting participation trends. First, a significant portion of reliability customers have adapted their curtailment planning and actions from the infrequent, compliance-driven framework of reliability programs to the more frequent, voluntary framework of price-responsive programs. However, the fact that a significant portion of participation in price-responsive programs is coming from existing reliability customers also indicates that the level and growth of participation in price-responsive programs from customers who had not previously participated in any DR program is significantly less than it would otherwise appear.



## SESSION 4B

### INCREASE YOUR COMMERCIAL AND GOVERNMENT PROGRAM IMPACTS

*Moderator: David Ciepluch, We Energies*

#### PAPERS:

##### **Get the Government! Understanding and Serving Government Customers through Energy Efficiency Programs**

David Kyle, Efficiency Maine  
Kevin Galligan, Cape Light Compact  
Elizabeth Titus, Northeast Energy Efficiency Partnership  
Lark Lee, PA Consulting Group  
Carol Sabo, PA Consulting Group  
Tom Giffen, SAIC

##### **Methodology for the Evaluation of an Energy Saving Performance Contracting Program for the U.S. Federal Government**

John A. Shonder, Oak Ridge National Laboratory  
Patrick J. Hughes, Oak Ridge National Laboratory  
Martin Schweitzer, Oak Ridge National Laboratory  
Richard Schmoyer, Oak Ridge National Laboratory

##### **Decision-making in the Commercial Office Building Market: Targeting Key Players in the Office Submarket**

John H. Reed, Innovologie  
Moria Morrissey, Innovologie  
Charles Bailey, Innovologie  
Jeff Riggert, Innovologie  
Isabelle Gecils, PG&E  
Peter Turnbull, PG&E

##### **Evaluating the Impacts of an Energy Study Program**

Dakers Gowans, Nexant

#### SESSION SUMMARY:

Many program implementers have had to deal with market penetration with various programs and business sectors. Most forms of government are dealing with annual budget constraints and energy efficiency is a neglected avenue to help them reduce their operational cost. The office market place forms a large group of buildings that consume a lot of energy. Building management dynamics and strategies vary from different business arrangements. Performance contracts are another tool that can be used to help manage projects and their cost over time. Many efficiency implementers use technical assistance, energy surveys and studies to assist and persuade customers' to install improvement measures to their benefit. The presenters have applied process evaluation to these markets to explore and recommend strategies and solutions that can improve program penetration with efficiency measures.

Examples will be shared of successful government programming. Building management is broken out into major subgroups to utilize specific strategies with each to improve efficiency programs.

Large performance contract analysis is shared and how effective are these contracts at meeting performance goals. Technical assistance and studies can be a great tool for energy efficiency gains but there can be improvements with the approach.

# **Get the Government! Understanding and Serving Government Customers through Energy Efficiency Programs**

*David Kyle, Efficiency Maine*

*Kevin Galligan, Cape Light Compact*

*Elizabeth Titus, Northeast Energy Efficiency Partnership*

*Lark Lee and Carol Sabo, PA Consulting Group*

*Tom Giffen, SAIC*

## **Abstract**

This paper discusses factors which influence the level of participation by the government sector in energy-efficiency programs. The paper focuses on local governments and schools (K-12) that have participated in the Cape Light Compact and Efficiency Maine programs. Factors are identified using customer surveys, site visits, and database analysis. The paper also draws upon the experience of the evaluation team in other government sector program.

The intent of the paper is to provide background information that will assist program managers and evaluators in understanding the unique needs of the government sector and considering those needs in program design and assessment. In particular, the paper discusses several barriers to program participation and the approaches to overcoming those barriers that have been used successfully in actual programs.

# **Methodology for the Evaluation of an Energy Savings Performance Contracting Program for the U.S. Federal Government**

*John A. Shonder*

*Patrick J. Hughes*

*Martin Schweitzer*

*Richard Schmoyer*

*Oak Ridge National Laboratory, Oak Ridge, TN*

## **ABSTRACT**

An Energy Savings Performance Contract (ESPC) is a method of funding energy conservation measures using the cost savings that result from the measures themselves. Currently the most widely used vehicles for implementing ESPCs in the U.S. federal government are the Super ESPC contracts administered by the U.S. Department of Energy's Federal Energy Management Program. The principal objective of an evaluation being carried out by the authors is to compare the cost and energy savings predicted for Super ESPCs with the actual savings achieved by those projects to date. The evaluation uses a three-tier nested design, with increasingly intensive and more rigorous methods being applied to smaller and smaller samples. A key feature of Super ESPCs is the requirement for ESCOs to produce annual measurement and verification (M&V) reports, and the first tier of the evaluation is based on review of the most recent annual M&V reports for all Super ESPC projects in their performance periods to compare reported savings with guaranteed savings. The second tier of the evaluation focuses on a stratified random sample of 25 projects, with the objective of recalculating the savings reported in the most recent annual M&V report according to the algorithms specified in the contracts. Analysis in Tier 3 is focused on a smaller subsample of projects that meet validity criteria for whole-building or whole-facility data analysis, with the objective of comparing pre- and post-retrofit energy costs to verify the savings that have been achieved. This paper presents an overview of the evaluation design, describes the criteria for selection of the subsample, and includes preliminary results from Tier 1.

# **Decision-making in the Commercial Office Buildings Market: Targeting Key Players in the Office Submarket**

*John H. Reed, Innovologie*  
*Moria Morrissey, Innovologie*  
*Charles Bailey, Innovologie*  
*Jeff Riggert, Innovologie*  
*Isabelle Gecils, PG&E*  
*Peter Turnbull, PG&E*

## **Abstract**

Traditionally utility and public goods charge programs have tended to promote energy efficiency in commercial office lease space on a building-by-building basis. There are a relatively small number of firms that control large amounts of lease space and about 25 firms that build a substantial percentage of new office lease space. We argue that the existing building-by-building approach should be complemented by an approach that targets all buildings owned by a property company or at least all buildings being served in a jurisdiction or service territory that are owned or managed by a single company. Those who make investment decisions differ from those who make decisions about efficiency measures. We believe that a top down approach may accelerate the rate at which energy efficiency penetrates the commercial building market. In order for such a strategy to work it is important to realize that property firms differ and that there are other types of firms and organizations that make or support investment decisions. We identify and discuss five such types of organizations.

In addition, the paper observes that there is little support for the idea that incentives are split between owners and tenants in the commercial office lease sector. The paper briefly comments upon the increased turnover in building ownership and the effect that has on energy efficiency. The paper also reports increased interest in global warming and sustainable buildings in the commercial lease sector. Finally the paper reports some interest on the part of certain building operators in encouraging improved tenant efficiency behaviors.

# Evaluating the Impacts of an Energy Study Program

## *A Case Study*

*Dakers Gowans, Nexant, White Plains, NY*

### **ABSTRACT**

This paper is a case study of the challenges that were addressed while conducting an impact evaluation of the Technical Assistance Program (TAP), a systems benefit charge program operated by the New York State Energy Research and Development Authority (NYSERDA). The TAP provides funding to conduct energy feasibility, rate analysis, and operational studies as well as walk-through audits of small facilities, and it accounts for nearly a third of the annual kWh savings reported by NYSEDA's portfolio of programs. The evaluation was conducted in 2004 and then updated in 2006; prior to this period impact estimates were based on responses to a telephone survey of program participants.

The purpose of the evaluation was to obtain the best possible estimate of the energy (kWh/year, MMBtu/year) savings and demand (kW) reductions that have resulted from the program's operations. TAP participants are not required to implement any recommendations made in their feasibility studies, nor are they required to report installation activity back to NYSEDA if they do elect to act on the recommendations. A detailed research plan was developed in 2004 specifically addressing this absence of a continuing relationship between the TAP and its customers. The plan called for sampling the program's 827 completed studies (over 1,027 in 2006) by stratifying the population between large projects with recommended savings greater than 1,000,000 kWh/year, and all smaller projects. In order to focus resources on studies that contribute the greatest risk or value to the program's reported savings the sample was weighted so that 80% of the sampled reports were drawn from the stratum of large projects.

In 2004, a significant challenge for the sampling plan was the lack of a comprehensive tracking data base for the program. The solution was to draw samples of studies in three rounds using the best information about the population that was available at the time of the draw, while simultaneously populating a tracking database with information pulled from hard-copy file records. To ensure that the sample design criteria were maintained, sample strata were balanced at each draw by using the latest version of the database.

A key element of the research plan developed in 2004 to address the voluntary and un-reported implementation of the recommendations made in the studies was to disaggregate the standard realization rate into two components. These are: the Measure Adoption Rate (MAR), the ratio of self-reported installed measures to study-recommended measures; and the Savings Realization Rate (SRR), the ratio of installed kWh/year as determined through engineering reviews and site visits, to the study-estimated kWh/year for the measures reported by customers to have been installed. Developing the MAR, which was based on customer response to a telephone questionnaire, allowed investigators to identify projects for site visit review. Finally, project and program realization rates were the product of MAR times SRR.

## SESSION 4C

### THE GREENING OF AMERICA....TALES FROM THE FIELD

*Moderator: Rich Hackner, GDS Associates*

#### PAPERS:

##### **Field Performance Reviews of Green and Sustainable Buildings**

Catherine Turner, New Buildings Institute

##### **A Performance Evaluation Study of Photovoltaic Systems Installed through the Long Island Power Authority's Clean Energy Initiative Solar Pioneer Program**

Ann Clarke, Long Island Power Authority

Robb Aldrich, Steven Winter Associates, Inc.

Robert Allgor, Long Island Power Authority

David Hill, Vermont Energy Investment Corporation

Ralph Prael, Prael & Associates

##### **The Green, Green Grassroots of Home: Measuring Community-Based Clean Energy Market Development Initiatives in Connecticut**

Timothy Pettit, Nexus Market Research, Inc.

Robert Wall, Connecticut Innovations, Inc.

J. Gregory Clendenning, Nexus Market Research, Inc.

#### SESSION SUMMARY:

Sustainable building practices are being promoted by an ever broadening set of stakeholders. This session explores the efforts of three programs from across the United States that are helping promote green building development. Topics covered include; market acceptance, field performance, and community support that are creating interest in and furthering the development of green building program design.

The first paper, "*Field Performance Reviews of Green and Sustainable Buildings*" covers market research on barriers to performance evaluations, a protocol to address those barriers, and results from initial field measurements.

Green and sustainable building programs often estimate anticipated savings from energy efficiency measures, but actual results are rarely measured. This lack of post-occupancy evaluation limits the ability to gauge true progress and precludes feedback to owners, operators, and designers. Such feedback could hasten the achievement of improved efficiency. To address this situation, this paper covers three facets of the New Buildings Institute's efforts to expand the use of performance reviews: market research into evaluation methods and barriers to their wide use, a protocol to address those barriers, and results from initial field measurements.

Based on this research, a widely used building performance protocol must gather readily available performance data from multiple sources and focus on understandable, actionable interpretations. A staged approach can permit a low initial cost and gives an informed basis for a more targeted diagnostic effort when called for. Field tests of the measurement protocol were conducted on a varied group of buildings with a mixture of ages and sustainability features. Energy usage results are presented in relation to several alternative benchmarks, ranging from existing building averages to building-specific design elements. Occupant satisfaction results are shown in areas of temperature, acoustics, air quality, and light, to help distinguish between buildings with true efficiency gains and

those that merely save energy at the cost of occupant functional comfort. Consistent gathering of such information can facilitate owners' actions toward increased building efficiency as well as develop aggregate data for assessing both the energy and non-energy value of green building efforts.

The second paper, entitled, "A Performance Evaluation Study of Photovoltaic Systems Installed through the Long Island Power Authority's (LIPA) Clean Energy Initiative Solar Pioneer Program" documents the performance of the program over its initial six years. Introduced in 1999 as part of LIPA's Clean Energy Initiative, the Solar Pioneer Program promotes the installation of solar photovoltaic (PV) systems as an environmentally clean and viable alternative to electricity generated from fossil fuels. LIPA has committed to transforming the market for PV on Long Island by: increasing consumer awareness and market demand for PV systems; accelerating the development of a vibrant, self-sustaining local infrastructure for the delivery and maintenance of quality PV systems; reducing institutional barriers to streamlined system installations; and developing mechanisms to overcome financial barriers to purchasing PV systems. Although the original focus of the Solar Pioneer Program was on the residential market, in 2001 rebates were also made available to commercial customers. Key questions answered by the evaluation include: How does the expected output of PV systems compare with the actual output of rebated systems once they are installed? Does the performance persist over time? Are customer and planning expectations of performance consistent with in-field experience?

And, finally, the third paper, entitled, "*The Green, Green Grassroots of Home: Measuring Community-Based Clean Energy Market Development Initiatives in Connecticut*" details a community-based environmental program intended to engage and motivate a community's local government, businesses, organizations, and residents to adopt environmentally beneficial behaviors by raising community awareness and leveraging community pride. In Connecticut, such a community-based approach is being applied to a voluntary program in which ratepayers can elect to purchase clean energy through their current electric utility. This clean energy voluntary purchasing program (the CTCleanEnergyOptions<sup>sm</sup>) was launched in April 2005 by the Connecticut Department of Public Utility Control as enabled by Connecticut State Assembly Public Act 03-135. To develop this voluntary market demand for clean energy, the Connecticut Clean Energy Fund (CCEF) launched a series of community-based initiatives to accelerate the rate of subscription to this clean energy purchasing program by ratepayers across the state<sup>1</sup>. By September 2005, subscriptions exceeded total subscriptions to an earlier program that failed to deliver a sustainable subscription base for clean energy market development after 2.5 years from 2000 to 2003. The hypothesis is that the CCEF community-based initiatives jump-started the growth in subscriptions largely from the participating communities. A number of alternative hypotheses were developed to explain this rapid program startup and sustained growth. All alternative hypotheses were rejected in favor of the conclusion that the community-based initiatives had a powerful effect on jump-starting the market for clean energy in Connecticut, delivering clean energy subscriptions at nearly double the rate of nonparticipating communities, even as community participation and subscription rates continue to climb.

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<sup>1</sup> The CTCleanEnergyOptions program is available to all customers of the state's two large electric utility companies, The Connecticut Light & Power Company and United Illuminating Company, which provide service to all or parts of 166 of the 169 municipalities in Connecticut. The clean energy program is not, however, currently available in the handful of municipalities (3) served solely by a municipal electric utility.



# Field Performance Reviews of Green and Sustainable Buildings

*Catherine Turner, New Buildings Institute, White Salmon, WA*

## **ABSTRACT**

Actual energy performance feedback leads to increased commercial building efficiency, but actual building performance is rarely measured. This paper covers market research on barriers to performance evaluations, a protocol to address those barriers, and results from initial field measurements.

A literature review and market research showed that a wide variety of methods used to evaluate actual building performance, but none has been standardized and widely implemented. Well-documented barriers to achieving feedback from traditional post-occupancy evaluations include technical, cost, and timing challenges. Interviews with designers and owners identified the information most useful to them.

Based on this research, a widely used building performance protocol must gather readily available performance data from multiple sources and focus on understandable, actionable interpretations. A staged approach can permit a low initial cost and gives an informed basis for a more targeted diagnostic effort when called for. Field tests of the measurement protocol were conducted on a varied group of buildings with a mixture of ages and sustainability features. Energy usage results are presented in relation to several alternative benchmarks, ranging from existing building averages to building-specific design elements. Occupant satisfaction results are shown in areas of temperature, acoustics, air quality, and light, to help distinguish between buildings with true efficiency gains and those that merely save energy at the cost of occupant functional comfort. Consistent gathering of such information can facilitate owners' actions toward increased building efficiency as well as develop aggregate data for assessing both the energy and non-energy value of green building efforts.

# **A Performance Evaluation Study of Photovoltaic Systems Installed through the Long Island Power Authority's Clean Energy Initiative Solar Pioneer Program**

*Ann Clarke, Long Island Power Authority, Melville, NY*  
*Robb Aldrich, Steven Winter Associates, Inc., Norwalk, CT*  
*Robert Allgor, Long Island Power Authority, Melville, NY*  
*David Hill, Vermont Energy Investment Corporation, Burlington, VT*  
*Ralph Prahl, Prahl & Associates, Madison, WI*

## **Abstract**

Solar photovoltaics (PV) technology holds significant promise, including environmental benefits, modularity, ease of siting, and high coincidence with the electric utility's system peak, fueling a rapid growth rate in the industry. The Long Island Power Authority (LIPA) in New York has paid rebates totaling more than \$25 million for over 1,000 grid-connected PV installations through their Clean Energy Initiative Solar Pioneer Program. Because of this level of commitment, it is important to verify that PV equipment is being designed and installed properly.

The performance of PV systems depends upon a number of factors, including: system design, or the appropriate matching of system components; quality of the installation, including proper wire sizing and connections; site conditions, such as solar access including shading; and the performance of major system components, such as PV panels and inverters. In order to verify equipment performance, LIPA decided to conduct a three-year study including both in-field site inspections and monitoring of system output. This paper summarizes the first six months of results from the study. As of June 30, thirty-five site inspections have been completed by Steven Winter Associates (SWA), the contractor selected for this study. Monitoring equipment is scheduled to be installed this fall, after the first year's site inspections are completed.

Because this study is ongoing, the results summarized in this paper are preliminary and are still being assessed. Further analyses will be presented at the conference in August.

# **The Green, Green Grassroots of Home: Measuring Community-Based Clean Energy Market Development Initiatives in Connecticut**

*Timothy Pettit, Nexus Market Research, Inc., Arlington, VA*  
*Robert Wall, Connecticut Innovations, Inc., Rocky Hill, CT*  
*J. Gregory Clendenning, Nexus Market Research, Inc., Arlington, VA*

## **Abstract**

Community-based environmental programs are intended to engage and motivate a community's local government, businesses, organizations, and residents to adopt environmentally beneficial behaviors by raising community awareness and leveraging community pride. In Connecticut, such a community-based approach is being applied to a voluntary program in which ratepayers can elect to purchase clean energy through their current electric utility. This clean energy voluntary purchasing program (the CTCleanEnergyOptions<sup>sm</sup>) was launched in April 2005 by the Connecticut Department of Public Utility Control as enabled by Connecticut State Assembly Public Act 03-135. To develop this voluntary market demand for clean energy, the Connecticut Clean Energy Fund (CCEF) launched a series of community-based initiatives to accelerate the rate of subscription to this clean energy purchasing program by ratepayers across the state<sup>1</sup>. By September 2005, subscriptions exceeded total subscriptions to an earlier program that failed to deliver a sustainable subscription base for clean energy market development after 2.5 years from 2000 to 2003. The hypothesis is that the CCEF community-based initiatives jump-started the growth in subscriptions largely from the participating communities. A number of alternative hypotheses were developed to explain this rapid program startup and sustained growth. All alternative hypotheses were rejected in favor of the conclusion that the community-based initiatives had a powerful effect on jump-starting the market for clean energy in Connecticut, delivering clean energy subscriptions at nearly double the rate of nonparticipating communities, even as community participation and subscription rates continue to climb.

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<sup>1</sup> The CTCleanEnergyOptions program is available to all customers of the state's two large electric utility companies, The Connecticut Light & Power Company and United Illuminating Company, which provide service to all or parts of 166 of the 169 municipalities in Connecticut. The clean energy program is not, however, currently available in the handful of municipalities (3) served solely by a municipal electric utility.

## SESSION 4D

### ATTRIBUTION AND PUBLIC POLICY

*Moderator: Ralph Prahl, Prahl & Associates*

#### PAPERS:

**Free Ridership and Spillover: A Regulatory Dilemma**

William P. Saxonis, New York State Department of Public Service

**Maximizing Societal Uptake of Energy Efficiency in the New Millennium:**

**Time for Net-to-Gross to Get Out of the Way?**

Rafael Friedmann, Pacific Gas & Electric Co.

**Market-Effects Momentum: Are We Giving Market Effects Their Full Due?**

Dr. Harley H. Barnes, Lockheed Martin

#### SESSION SUMMARY:

This session presents three new contributions to the recent debates regarding the proper role of attribution and net-to-gross analysis in public policy.

Saxonis critically examines recent free riding and spillover results from energy efficiency programs in New York, finding that spillover represents a bigger impact there than in other states. His suggestions for improving the usefulness of free riding and spillover results to regulators and other policy makers include: increasing collaboration between states and other interested parties; and paying more attention to the connections between changes in free rider and spillover levels and changes in markets and economic conditions.

Friedmann calls for major changes in California's policies and protocols regarding the evaluation of attribution-related issues, arguing that the current strong focus on estimating free riding inhibits the development of innovative programs, leads to misallocation of resources, and causes insuperable technical challenges.

Finally, Barnes reviews the policy implications of failing to recognize momentum effects, or end-users who adopt energy-efficiency measures in time periods after the program year in which they were exposed to the program's activities. He concludes that most program planners and evaluators have not been giving market effects their full due.

## Free Ridership and Spillover: A Regulatory Dilemma

*William P. Saxonis, New York State Department of Public Service, Albany, NY\**

### ABSTRACT

Techniques for the measurement of free ridership have improved in recent years, but estimates still frequently suffer from a fairly high degree of uncertainty. The measurement of spillover has been even less certain. Can regulators rely on this data to help guide decisions on program design, budgets, program performance and energy policy? Currently there is a wide variance across the nation regarding how regulators view and utilize free rider and spillover data. There have been many studies addressing free ridership and spillover but relatively few have examined these factors in tandem, including exploring their combined impact on a program's benefit to cost ratio (B/C), and as tools for better understanding the marketplace, especially consumer behavior.

This paper critically examines recent free rider and spillover results from energy efficiency programs administered by the New York State Energy Research and Development Authority (NYSERDA). Based on recent NYSERDA program results, the free rider rates for commercial and industrial (C&I) programs ranged from 10-67 percent and the spillover rates ranged from 19 to 168 percent. For residential programs, the statistics are only somewhat less dramatic with free ridership ranging from 2-28 percent and spillover from 5 to 48 percent. Impacts of this magnitude can have a major influence on calculating net energy impacts and ultimately a program's B/C ratio. These results strongly suggest that a better understanding of free ridership and spillover is critical for the regulatory, evaluation and program design communities. This paper places free rider and spillover measurement in a historical context, compares the NYSERDA results to results from other states and concludes with challenging, but practical, recommendations.

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\* Any opinion expressed explicitly or implicitly are those of the author and do not necessarily represent those of the New York State Department of Public Service or the members of the Public Service Commission.

# **Maximizing Societal Uptake of Energy Efficiency in the New Millennium: Time for Net-to-Gross to Get Out of the Way?**

*Rafael Friedmann, Pacific Gas & Electric Co., San Francisco, CA<sup>1</sup>*

## **ABSTRACT**

Humans are running out of time to reduce global warming gas emissions to avoid horrendous socio-political and environmental consequences. Reducing global warming effects may require an 80% decrease in greenhouse-gas emissions by the year 2050. This will require a sharp reduction in the use of fossil-fuels our modern civilization is based on. Widespread uptake of energy efficiency and conservation are the best options available to mitigate global climate change and provide time for developing more sustainable and renewable energy supply sources.

California's thirty-year promotion of energy efficiency provides valuable experience and an institutional and market infrastructure to broaden and deepen customer uptake of energy conservation and efficiency. California policymakers, entrepreneurs, and public show a heightened interest in energy efficiency.

To accelerate uptake of energy efficiency will require California to update evaluation policies and protocols for overseeing the almost one billion dollar per year publicly funded energy efficiency endeavor. Current evaluation is more focused on regulators need of attributing energy savings to specific programs and less so on optimizing interventions. Programs and evaluations are focusing mostly on energy efficient measures (EEMs) that get incentives.

This paper calls both evaluators and policy-makers overseeing energy efficiency portfolios to acknowledge the need for, and move to develop alternate evaluation policies, protocols and methods that will ensure publicly funded energy efficiency efforts are cost-effective, while also being supportive of non-traditional, more economical and deep market transforming interventions. These new evaluation policies and protocols should still ensure continued public oversight. The paper draws upon the California context to show how the Net-to-Gross ratio as currently applied inhibits new, market transforming energy efficiency interventions. Paper ends providing some initial thoughts on how to improve this situation.

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<sup>1</sup> Any opinions expressed explicitly or implicitly are those of the author and do not necessarily represent those of Pacific Gas and Electric Company.

# **Market-Effects Momentum: Are We Giving Market Effects Their Full Due?**

*Dr. Harley H. Barnes, Lockheed Martin, Rockville, MD<sup>1</sup>*

## **ABSTRACT**

Energy-efficiency programs, whether they have a resource-acquisition or a market transformation goal, stimulate end users to adopt energy-efficiency measures not only during the program year in which they were exposed to program activities but also in subsequent years. The belief that this will occur justifies market-transformation programs. For resource-acquisition programs, this effect occurs when program participants decide that the promoted energy-efficiency measure was a good choice and return to make that choice again. These lagged energy-efficiency adoptions represent sales *momentum* caused by a program's activities. When we evaluate a program using regression modeling with a *program* variable, these momentum effects are captured if we have a good non-intervention baseline. But when we evaluate using a *participation* variable, or have an inadequate baseline, or when we use rebate-redemption counts and free-ridership surveys, we can expect to miss some of the momentum effects attributable to our program. When we evaluate a proposed program's cost effectiveness without using post-program momentum effects, we may reject it when it would otherwise be cost effective. This paper describes the "market-effects momentum" concept, reviews three recent evaluations that address it, and examines its implications for free-ridership, cost effectiveness, forward capacity markets, and cap and trade programs for greenhouse gas.

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<sup>1</sup> The opinions expressed in this paper are those of the author and do not necessarily reflect those of Lockheed Martin.

## SESSION 4E

### WHAT IMPLEMENTERS NEED FROM EVALUATORS

*Moderator: Meg Matt, Association of Energy Services Professionals*

#### PANELISTS:

Rick Gerardi, Lockheed Martin  
Kathy Kuntz, Wisconsin Energy Conservation Corporation  
Sue Nathan, Applied Energy Group

#### SESSION SUMMARY:

Why can't implementers and evaluators just get along? Sound familiar?

Hearing—and then acting upon—input from evaluators can be a real challenge for program implementers. Program implementation staff are like quarterbacks—calling plays in a real-time effort to get results and often resenting those who second-guess their efforts after the fact. But while quarterbacks can snarl at the reporter who asks about the interception, our program teams need to work collaboratively with evaluation personnel to increase program effectiveness. Our games are ongoing and programs are most successful when there is a healthy dialogue between implementation and evaluation staffs.

So how do you make it happen? AESP invites evaluators and implementers to this session to discuss, debate and increase understanding between the two disciplines.

This panel will:

- Identify some of the typical challenges implementers and evaluators may face when working together
- Provide real-life examples on how evaluators and implementers can work together to address issues
- Provide suggestions on how to change program protocols and revise energy savings estimates in a collaborative working relationship
- When should evaluators get involved in a program? When is too soon? Is there a rule of thumb about when it is most cost effective?
- How do evaluators know what is important to the regulatory agencies of the states the programs are being offered in?
- Why can't evaluators talk in English?
- If evaluators have seen what does and doesn't work in other places, should they be allowed to be program designers? What about letting evaluators have input into program design? Does this bias the evaluation effort?
- Should evaluators and implementers be separated within the utility?
- What can be done to get evaluation results faster so that they can be used in real time by program implementers?
- Evaluators often comment that implementers ignore their recommendations. What might mitigate this?



Join us for a lively panel discussion that represents the rewards and challenges of implementation and evaluation of energy efficiency programs.

## SESSION 5A

### GIVING BACK: COGENERATION AND RENEWABLE ENERGY SYSTEMS

*Moderator: Ann M. Clarke, Long Island Power Authority*

#### PAPERS:

##### **Power to the People: The Benefits of a De-Centralized Reporting Strategy for Tracking the Performance of Publicly Funded Renewable Energy Systems in Massachusetts**

Shawn Shaw, The Cadmus Group Inc.  
David Beavers, The Cadmus Group Inc.  
Emma Kosciak, The Cadmus Group Inc.  
Kelly Dexter, Massachusetts Technology Collaborative  
Tyler Leeds, Massachusetts Technology Collaborative  
Jon Abe, Massachusetts Technology Collaborative

##### **Performance Assessment of Cogeneration Systems in California**

Brad Souza, Itron Inc.  
Kumar Chittory, Itron Inc.  
Pierre Landry, Southern California Edison  
George Simons, Itron Inc.

##### **The Impact of Distributed Generation Facilities on California's Transmission and Distribution System**

George Simons, Itron Inc.  
Snuller Price, Energy and Environmental Economics  
Ron Davis, Davis Power Consultants

#### SESSION SUMMARY:

Cogeneration and renewable energy systems are increasingly the recipients of rate-payer and tax-payer funded incentives for their numerous benefits to customers, the environment, and the electric system. Because it is so important to ensure that these funds are being spent wisely, system performance evaluation is necessary. This session focuses on a unique strategy for tracking the performance of renewable energy systems in Massachusetts, a performance assessment of cogeneration systems in California, and then examines the effect of all distributed generation on California's T&D system.

In the first paper, the authors demonstrate that centralized, single-source packaged Data Acquisition Systems (DAS) are not necessary to insure accurate and reliable reporting. With the proper reporting system such as the Production Tracking System (PTS), supported by the Massachusetts Technology Collaborative (MTC), it is possible to interface human and automated reporting systems. This decentralization of the reporting process has several key benefits: identification and correction of malfunctions, increased competition among DAS providers, reductions of RE system costs, and increased RE system owner involvement.

The authors examine technologies associated with tracking renewable energy (RE) system performance, current performance tracking at the state level, the benefits of decentralized performance tracking methods, and recommendations that policymakers can utilize in designing/revising RE programs to reduce program costs, increase public benefits, and improve program participation.

The second paper presents the results of an in-depth performance evaluation that was conducted for California's Self-Generation Incentive Program (SGIP) Working Group to evaluate the effectiveness of useful thermal energy recovery of on-site cogeneration systems receiving incentives from the program. In an earlier study, an initial evaluation of cogeneration system cost-effectiveness was performed for SGIP. This study raised some interesting questions regarding the actual operational efficiencies of cogeneration systems. Incorporating fuel consumption, thermal energy recovery and prime mover performance data obtained through the Program's measurement and evaluation monitoring efforts, actual measured performance was compared with the engineering estimates of performance for each project

This paper also explores some of the key drivers behind the unexpectedly low thermal energy recovery and overall plant performance. Because the performance data include the actual timing (hour and month) of cogeneration system operation, the effects of this distributed generation resource is evaluated taking into account the large differences between peak and off-peak energy costs and benefits. This program-level distributed generation analysis can help program designers and policy makers to understand the limitations of smaller cogeneration applications relative to those systems envisioned under PURPA and thus may have important policy implications for the future of cogeneration and distributed generation programs throughout the U.S.

The third paper examines the impact of distributed generation (DG) facilities on California's transmission and distribution (T&D) system. Distributed generation (DG) technologies have been portrayed as an emerging face of tomorrow's electricity system. DG facilities are expected to provide a significant and wide variety of benefits to grid operations, including reduced peak loading on distribution feeders, lower congestion on transmission lines, increased system reliability, and cost reductions associated with deferred or eliminated need for new or expanded distribution or transmission infrastructure. To date, limited penetration of DG technologies has made it difficult to accurately estimate their impacts on the T&D system. Under California's Self-Generation Incentive Program (SGIP), over 1000 DG facilities representing approximately 260 megawatts (MW) of capacity have been installed and monitored. Measured generation performance data for DG facilities operating during calendar year 2006 were used to assess their affect on the T&D system.

# **Power to the People: The Benefits of a Decentralized Reporting Strategy for Tracking the Performance of Publicly Funded Renewable Energy Systems**

*David Beavers, Shawn Shaw, and Emma Kosciak, The Cadmus Group Inc, Watertown MA..  
Kelly Dexter, Tyler Leeds, and Jon Abe, Massachusetts Technology Collaborative, Westborough, MA.*

## **ABSTRACT**

There is growing demand for renewable energy systems. However, there is currently no nationwide standard for tracking and reporting the performance of these systems. Looking forward, this will equally apply to distributed generators of “white tags”, as well as continued applicability to distributed generation (DG)/renewable energy (RE) production.

Understanding the tracking/reporting process requires we ask several key questions:

- Why track?
- What tracking systems already exist? How do they work?
- What considerations set small and large generators apart for tracking purposes?
- What level of precision is appropriate for reporting production and Renewable Energy Certificates (RECs)?
- What are the advantages/disadvantages of decentralized reporting?

The authors will show that the long held belief that packaged Data Acquisition Systems (DAS) are necessary to insure accurate and reliable reporting is not always true. With the proper reporting system such as the Production Tracking System (PTS), supported by the Massachusetts Technology Collaborative (MTC), it is possible to interface human and automated reporting systems. This decentralization of the reporting process has several key benefits:

- Identification and correction of malfunctions
- Increases DAS provider competition
- RE system cost reduction
- Increased RE system owner involvement

In this paper, the authors will examine technologies associated with tracking RE system performance, current performance tracking at the state level, the benefits of decentralized performance tracking methods, and recommendations that policymakers can utilize in designing/revising RE programs to reduce program costs, increase public benefits, and improve program participation.

# Performance Assessment of Cogeneration Systems in California

*Brad Souza, Itron Inc., San Diego, CA*  
*Kumar Chittory, Itron Inc., San Diego, CA*  
*Pierre Landry, Southern California Edison, Irwindale, CA*  
*George Simons, Itron Inc., San Diego, CA*

## Abstract

Over the past several years, customer-sited cogeneration systems have been viewed as one way to mitigate electrical supply shortages. On the utility side, achieving this goal requires that cogeneration systems operate at a relatively high capacity factor, especially during peak periods. On the customer side, the cogeneration system must be capable of reducing operating costs. Our firm has recently completed an evaluation of operational customer-sited cogeneration systems installed during 2002 through 2004 under the Self-Generation Incentive Program (SGIP). This paper will present the results of an in-depth performance evaluation that was conducted for the SGIP Working Group to evaluate the effectiveness of useful thermal energy recovery of on-site cogeneration systems receiving incentives from the program.

In an earlier study, an initial evaluation of cogeneration system cost-effectiveness was performed for SGIP. This study raised some interesting questions regarding the actual operational efficiencies of cogeneration systems. Incorporating fuel consumption, thermal energy recovery and prime mover performance data obtained through the Program's measurement and evaluation monitoring efforts, actual measured performance was compared with the engineering estimates of performance for each project.

This paper will also explore some of the key drivers behind the unexpectedly low thermal energy recovery and overall plant performance. A stepwise approach to reconciling the estimated and actual performance was implemented. If common threads were identified, they were documented in an effort to guide future cogeneration system installations. Because the performance data include the actual timing (hour and month) of cogeneration system operation, the effects of this distributed generation resource is evaluated taking into account the large differences between peak and off-peak energy costs and benefits. This program-level distributed generation analysis can help program designers and policy makers to understand the limitations of smaller cogeneration applications relative to those systems envisioned under PURPA and thus may have important policy implications for the future of cogeneration and distributed generation programs throughout the U.S.

# **The Impact of Distributed Generation Facilities on California's Transmission and Distribution System**

*George Simons, Itron, Inc., Vancouver, WA*  
*Snuller Price, Energy and Environmental Economics, San Francisco, CA*  
*Ron Davis, Davis Power Consultants, San Jose, CA*

## **Abstract**

Distributed generation (DG) technologies have been portrayed as an emerging face of tomorrow's electricity system. DG facilities are expected to provide a significant and wide variety of benefits to grid operations, including reduced peak loading on distribution feeders, lower congestion on transmission lines, increased system reliability, and cost reductions associated with deferred or eliminated need for new or expanded distribution or transmission infrastructure. To date, limited penetration of DG technologies has made it difficult to accurately estimate their impacts on the transmission and distribution (T&D) system. Under California's Self-Generation Incentive Program (SGIP), over 1000 DG facilities representing approximately 260 megawatts (MW) of capacity have been installed and monitored. This paper examines the impact of DG facilities operating during calendar year 2006 on the state's transmission and distribution system using measured generation performance data.

## SESSION 5B

### PROGRAM THEORY AND LOGIC MODELS: FAIRYTALES OR REFERENCE MANUALS?

*Moderator: Sharyn Barata, Opinion Dynamics*

#### PAPERS:

#### **“Do I have to?”: Convincing Program Implementers that Program Logic Models are Valuable**

Victoria Engel, NYSERDA

Scott Albert, GDS Associates

Lynn Hoefgen, Nexus Market Research, Inc.

Lawrence J. Pakenas, NYSERDA

#### **Program Theory-Drive Evaluation Approach: An Exercise in Practice**

Cynthia M. Austin, Heschong Mahone Group, Inc.

#### **Using simplified Pattern Matching to Define Program Theory and Assess Program Effectiveness Application to a Green Buildings Program**

Dr. Allen D. Lee, Quantec

Dr. M. Sami Khawaja, Quantec

Michelle Levy, Quantec

#### SESSION SUMMARY:

Logic Models, which are designed to bring out the best and the worst in energy efficiency programs, also seem to sometimes bring out the best and worst in program implementers. This session will focus on the role that logic models and program theory should play in program design, operation and evaluation. It will also look at the barriers which will likely need to be addressed for logic models to gain acceptance and wide-spread use in your organization. Additionally the session will look at a unique method of combining concept mapping and pattern matching to elicit and test program theories. Finally, through a variety of examples and lessons learned, applications these three papers will highlight modeling techniques, new concepts and best practices related to logic models and program theories.

The first paper - *“Do I have to?”: Convincing Program and Evaluation Staff that Program Logic Models are Valuable* - looks at the acceptance of logic modeling by program implementers. It looks at the barriers to acceptance and provides suggestions for how these barriers can be overcome. It includes lessons learned and examples from direct experience with development of nearly 40 program logic models for a variety of ongoing and new energy efficiency, renewable resource, and research and development programs, as well as at the sector and portfolio levels. It also discusses how logic modeling has helped shape evaluation and provides a framework for tracking program progress.

The second paper - *Program Theory Drive Evaluation Approach: an Exercise in Practice* - provides a program theory model, using Chen, H. (2005) as a guide, for Southern California Edison's Local Government Partnership Program. This model was developed as part of the program's strategic business plan. The purpose of the model is to provide a succinct and useful program conceptualization for stakeholders involved in the program process.

The final paper in the session - *Using Simplified Pattern Matching to Define Program Theory and assess Program Effectiveness Application to a Green Buildings Program* - combines concept mapping and pattern matching to draw out and test program theories. The author feels that this method provides a means of comparing the program designers' program theory perceptions with those of

targeted market actors. This paper describes a simplified version of this program theory approach and provides insights on the theory's validity for a specific energy-efficient green building program.



# **“Do I have to?”: Convincing Program Implementers that Program Logic Models are Valuable<sup>1</sup>**

*Victoria S. Engel, NYSERDA, Albany, NY*  
*Scott Albert, GDS Associates, Inc., Manchester, NH*  
*Lynn Hoefgen, Nexus Market Research, Inc., Cambridge, MA*  
*Lawrence J. Pakenas, NYSERDA, Albany, NY*

## **ABSTRACT**

Logic modeling documents program inputs and activities and how they are expected to lead to outputs and outcomes. Reaction to and acceptance of logic modeling<sup>2</sup> can be mixed among program implementers. This paper explores reasons for this mixed reception and identifies ways to overcome misgivings.

Several barriers cause apprehension among program implementation staff regarding the logic modeling process, including: real imposition on their time; perceived questioning of their expertise; concern regarding content accuracy; objections to logic model formats (aesthetics); and lack of understanding or appreciation of the timing and associated benefits to be gained from their efforts. Related to all of these barriers is the common perception among some that they “already know” everything about a given program that could emerge from a logic model. Nonetheless, some implementers embrace logic models and the logic modeling process—including some who have initially been resistant, but through experience have come to value and depend on them.

This paper assesses these barriers and how they can be overcome. It includes examples from direct experience with development of nearly 40 program logic models for a variety of ongoing and new energy efficiency, renewable resource, and research and development programs, as well as at the sector and portfolio levels. It also discusses how logic modeling has helped shape evaluation and provides a framework for tracking program progress. The paper includes a number of lessons learned and ends with suggestions to help others use logic models more effectively in their organizations.

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<sup>1</sup> The views expressed in this paper are those of the authors and do not necessarily reflect the views of the New York State Energy Research and Development Authority.

<sup>2</sup> Although program-level logic models are highlighted in this paper, the same process and barriers can be faced when developing sector-level logic models.

# **Program Theory-Drive Evaluation Approach – An Exercise in Practice**

*Cynthia M. Austin, Heschong Mahone Group, Inc.*

## **ABSTRACT**

Chen, H. (1990) provided a comprehensive framework on the use of theory-oriented perspectives in program evaluation, discussing the nature and functions of program theory, approaches to constructing program theories, and the integration of program theory with evaluation processes. The framework relied on the ability for program implementers and evaluators to conceptualize understand programs through the use of program theory and/or logic models. Since then, the increasingly frequent use of logic models has been seen in energy efficiency as a tool for program conceptualization. In Chen, H. (2005), an updated version of conceptual modeling is introduced. The program theory model, seen in Chen, H. (2005), incorporates the use of a change model, explaining the descriptive assumptions, and the action model, describing the prescriptive assumptions, to provide a conceptual framework of program theory.

For Southern California Edison's Local Government Partnership Program, a program theory model, using Chen, H. (2005) as a guide, is developed as part of the program's strategic business plan. The purpose of the model is to provide a succinct and useful program conceptualization for stakeholders involved in the program process. The program theory model describes (1) the explicit and implicit assumptions made by program stakeholders about the actions required to obtain greater energy efficiency, and (2) how these actions will lead to specific outcomes that result in the program accomplishing its goals. The exercise allows us to study the implications of how the current applications of theory-driven program evaluation may be improved upon by the use of the Chen, H. (2005) program theory model from the commonly used logic models.

# **Using Simplified Pattern Matching to Define Program Theory and Assess Program Effectiveness—Application to a Green Buildings Program**

*Dr. Allen D. Lee, Quantec, LLC, Portland, OR*  
*Dr. M. Sami Khawaja, Quantec, LLC, Portland, OR*  
*Michelle Levy, Quantec, LLC, Portland, OR*

## **ABSTRACT**

Although efforts have increased to apply theory-based methods to evaluate energy-efficiency programs, implementation has been limited. One approach used in other fields is combining concept mapping and pattern matching to elicit and test program theories. This provides a means of comparing the program designers' program theory perceptions with those of targeted market actors. Concept mapping typically employs techniques to cluster either metric or non-metric data based on similarities, thus providing a map that groups concepts perceived to be similar. A program implementers' concept map can be used to reveal their perceptions about assumed linkages between program activities and expected outcomes (essentially the program theory). To test the theory, pattern matching is used to compare designer/implementer ratings of a program's expected effects on key outcomes with findings based on data from participants and differences observed between participants and non-participants.

This paper describes how we developed and applied a simplified version of this approach to articulate a program theory and provide insights on the theory's validity for a specific energy-efficient green building program. Program designer/implementer information was gathered from a one-day workshop, with follow-up submittals. The second step occurred during program evaluation when program participants were surveyed and asked to rate the barriers and the effectiveness of specific program services in reducing the barriers. These steps helped elucidate the program theory at project outset and provided the mechanism to compare anticipated program effects with actual outcomes and, therefore, test the consistency of the program theory against the reality of program outcomes.

## SESSION 5C

### EVALUATION OF LOW-INCOME PROGRAMS

*Moderator: Hugh “Gil” Peach, H. Gil Peach & Associates*

#### PAPERS:

##### **If It’s Affordable, Will They Pay? A Review of a Low Income Bill Payment Pilot Program**

Laura Schauer, PA Consulting Group  
Pam Rathbun, PA Consulting Group  
Lark Lee, PA Consulting Group  
Jim Cain, Wisconsin Department of Administration  
Michael Mueller, We Energies

##### **In Crisis, In Need, or In Want? Impacts of Policy Change on Wisconsin’s Crisis Assistance**

Pamela Rathbun, PA Consulting Group, Madison, WI  
Lark Lee, PA Consulting Group, Madison, WI  
Laura Schauer, PA Consulting Group, Madison, WI  
Jim Cain, Wisconsin Department of Administration, Madison, WI

##### **Energy Efficiency-Based Utility Allowance – Increasing the Affordability of Affordable Housing**

Julieann Summerford, HESCHONG MAHONE GROUP, INC., Encinitas, CA

##### **Evaluation of Energy Affordability Programs**

Dr. Jacqueline Berger, APPRISE, Princeton, NJ  
David Carroll, APPRISE, Princeton, NJ

##### **Evaluation of Low-Income Rate Designs**

H. Gil Peach, H. Gil Peach & Associates Beaverton, OR  
Ayala Cnaan, Rensselaer Polytechnic Institute, Troy, NY

#### SESSION SUMMARY:

The scope of Low-Income Program Evaluation concerns programs designed to serve households with insufficient income to fully manage a normal level of living. Four of the evaluations discuss *utility* and government programs; one examines a *housing* and government program. All are also *policy evaluations*, in that they go to the resolution of policy questions.

The paper by Schauer, Rathbun, Lee, Cain, and Mueller, “If It’s Affordable, Will They Pay? A Review of a Low Income Bill Payment Pilot Program,” is about an evaluation of a program proposed by We Energies and approved by the Public Service Commission of Wisconsin that is designed to keep low-income customers connected by changing factors closely connected to inability to pay energy bills. The program combines a reduced budget bill, an arrearage management component, limited case management, energy education and financial counseling. The evaluation has a clear discussion of methodology and uses program theory to frame the central research questions of the study. The approach facilitates the study’s review of process and design issues. One of the key findings in this study is that about 50% of households were able to regularly pay their energy bills (compared with 0% the year before). Another is that although case management is important in the theory of the program, it was inconsistently offered in the first year of the pilot.

The paper by Rathbun, Lee, Schauer and Cain, “In Crisis, In Need, or In Want? Impacts of Policy Change on Wisconsin’s Crisis Assistance,” is an empirical/policy study of the Wisconsin Home

Energy Assistance Program (WHEAP) which is supported by the federal Low-Income Home Energy Assistance Program (LIHEAP) and Wisconsin's Public Benefits Energy Assistance Program. The Wisconsin Department of Administration administers this statewide program through a network of local agencies. The program provides various forms of utility bill payment assistance with emergency furnace repairs and replacements. The focus of this study is to characterize the households that received large crisis assistance benefits in the past in order to understand why these households were in need of, or received, such a large benefit. The specific researchable questions are developed from the theory of the program. The methodology follows from the researchable questions and is clearly presented. The study concludes that Crisis Assistance is needed, and that it is reaching households most in need. Further, the program has the effect of reducing energy burdens and improving the household economic situation in several ways.

Summerford's paper, "Energy Efficiency-Based Utility Allowance – Increasing the Affordability of Affordable Housing," is an empirical policy evaluation of the introduction and operation of an intelligent policy option, Energy Efficiency-Based Utility Allowance (EEBUA) schedules in California. The study bridges the domains of housing policy evaluation and energy efficiency policy evaluation. Summerford discusses the evolution and methods of calculation of the Standard Utility Allowance. The standard method was developed in the context of affordability to keep people in homes. The "housing burden" (combination of rent plus utilities) is calculated without taking energy efficiency into account, and costs are averaged over buildings of different vintages and construction. EEBUA provides a way to refine the calculation by using energy efficiency in support of affordable housing. The benefits of EEBUA to the Public Housing Authorities include shared savings, training for implementation, and improved cash flow. This study is extensively concerned to illustrate the standard program theory embodied in existing practice, and the alternative of EEBUA. The study documents progress in working with housing authorities to adopt the EEBUA, the financial and energy savings impact of EEBUA on specific projects and the US Department of Housing and Urban Development's plans to endorse EEBUA nationwide.

Berger and Carroll, in "Evaluation of Energy Affordability Programs," develop a systematic overview of types of energy affordability programs. They also discuss the primary methods of evaluation of affordability programs and contrast empirical findings from four evaluations. The study concludes that low-income energy affordability programs can help households afford their energy bills and reduce their utility arrearages. This paper provides a realistic summary of both programs and methods of evaluation of affordability programs, and would be useful to an evaluator moving from another area of evaluation into the study of low-income programs.

Peach and Cnaan, in "Evaluation of Low-Income Rate Designs," focus on the ecological setting of low-income evaluations, asserting that the utility rate structure and general socioeconomic context are factors that should be studied and taken into account in all low-income evaluations. This is an example of Chen's (1990:125-126)<sup>1</sup> subtype, "Normative Implementation Environment Evaluation, Macro Context Evaluation" which stresses the importance of ecological and socioeconomic factors. The paper then looks at low-income rate design and discusses evaluation tools for the evaluation and design of workable utility rates that low-income households can afford to pay.

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<sup>1</sup> Chen, Huey-Tsyh, *Theory Driven Evaluations*. Newbury Park, London, New Delhi: Sage, 1990.

# **If It's Affordable, Will They Pay? A Review of a Low Income Bill Payment Pilot Program**

*By Laura Schauer, PA Consulting Group  
Pam Rathbun, PA Consulting Group  
Lark Lee, PA Consulting Group  
Jim Cain, Wisconsin Department of Administration  
Michael Mueller, We Energies*

## **ABSTRACT**

We Energies, Milwaukee-based community action agencies, and other local program partners designed the Low Income Pilot (LIP) around a vision that low-income customers will pay their energy bills if they are made more affordable to them. In March 2005, We Energies approached the Public Service Commission of Wisconsin (PSCW) to approve this three-year pilot program, which provides arrearage forgiveness and reduce payment agreements with low-income Milwaukee residents.

The program, as outlined in We Energies' proposal to the PSCW<sup>1</sup>, intended to “*keep [low-income] customers connected and ... aggressively change the factors that are most closely associated with low income customers' inability to pay their energy bills.*” The pilot plans to accomplish this goal through a flexible structure that does not include a “one strike you're out” approach. The LIP offers to participants: reduced budget bill payment amount; arrears forgiveness based on bill payment performance; allowances for limited payment failure; energy education and financial management counseling; and case management, defined by We Energies as follow-up when households do not fulfill program requirements.

The program, when compared against its goals, was moderately successful in the first year. However, the first program year experienced administrative difficulties that may have limited program success. Even with the early administrative limitations, this analysis shows that more households regularly paid their bills while on the program than off. Whether the positive bill payment behavior is purely a function of the reduced bill amount, or due in part to the ancillary services provided by the program, is not yet able to be determined.

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<sup>1</sup> Memorandum from We Energies to the Public Service Commission of Wisconsin, *Wisconsin Electric Power Company and Wisconsin Gas Company Low Income Pilot Program*. Docket No. 05-GF-144, dated November 29, 2004.

# **In Crisis, In Need, or In Want? Impacts of Policy Change on Wisconsin's Crisis Assistance**

*Pamela Rathbun, PA Consulting Group, Madison, WI*  
*Lark Lee, PA Consulting Group, Madison, WI*  
*Laura Schauer, PA Consulting Group, Madison, WI*  
*Jim Cain, Wisconsin Department of Administration, Madison, WI*

## **ABSTRACT**

The Wisconsin Department of Administration (DOA) administers the Wisconsin Home Energy Assistance Program (WHEAP) through a network of local agencies. WHEAP administers the federally funded Low Income Home Energy Assistance Program and the state's Public Benefits Energy Assistance Program. The majority of WHEAP funds are distributed to participants through energy bill payment assistance (regular benefits), and crisis assistance.

Crisis assistance provides emergency and pro-active services to assist clients with home energy costs beyond the WHEAP regular benefit amount. Wide latitude is afforded to local agencies in the delivery of crisis assistance. Starting in fiscal year 2007, DOA established \$1,000 as the maximum any household may receive in crisis assistance funds, unless an exception is approved by DOA. In addition, DOA is requiring clients to make a \$25 payment to their utility/fuel provider before receiving crisis assistance.

This study characterizes households that received high crisis assistance benefits in fiscal year 2006, reviews agencies' protocol on how they distribute crisis monies and the rationale for situations that warrant higher crisis benefits, and examines the impacts the policy changes will have on households and administering agencies.

Program database analysis and interviews with program managers and crisis recipients shows there is a real need for crisis assistance, and this assistance is reaching those in need of assistance beyond WHEAP. Households receiving higher crisis assistance benefits tend to have more financial constraints than those receiving lower benefits. There is also a lack of understanding among agencies on whether there are exceptions to the new cap.

# **Energy Efficiency-Based Utility Allowance – Increasing the Affordability of Affordable Housing**

*Julieann Summerford, HESCHONG MAHONE GROUP, INC., Encinitas, CA*

## **ABSTRACT**

This paper describes and addresses the unique barriers to energy efficiency existing in the Affordable Housing market. This paper also defines Energy Efficiency-Based Utility Allowance schedules (EEBUA) and how it addresses these barriers as well as present case studies of the financial and energy savings impact on specific projects throughout the state. Finally, the paper will provide an update on HUD's plans to support adopting EEBUA nationwide.



# **Evaluation of Energy Affordability Programs**

*Dr. Jacqueline Berger, APPRISE, Princeton, NJ*  
*David Carroll, APPRISE, Princeton, NJ*

## **Abstract**

Energy affordability programs have been implemented by state governments, public utility commissions, and utility companies around the country. The purposes of these programs are to make energy more affordable for low-income customers and reduce the problems that are associated with unaffordable energy bills. This paper describes how these programs are designed and evaluation strategies for assessing these programs. Results from several different affordability programs are compared and related back to differences in program design and implementation.

## **Evaluation of Low-Income Rate Designs**

*Dr. H. Gil Peach, H. Gil Peach & Associates LLC, Beaverton, OR  
Ayala Cnaan, Rensselaer Polytechnic Institute, Troy, NY*

### **Abstract**

Human behavior is shaped by environmental factors. Evaluation of low-income payment programs is assisted by including two ecological variables that are generally not fully developed in formal program theory: the rate design and the socioeconomic context. The rate design governs the “please pay” amount on customer bills and so is likely to have a much stronger effect on results than other program variables. Similarly, socioeconomic context can make the difference between well-designed programs working well and failing. This analysis highlights the relative proportion of participants for which the formal program may have a prospect of success.

Depending on the specific situation, the rate design may be the central feature of the program, or it may be seen as completely separate from the program. In the first case, evaluation of low-income rate designs is formally central to the evaluation. In the second case, the rate design may still be the key factor in program performance, even if formally “off limits.”

## SESSION 5D

### NON-ENERGY BENEFITS – WHAT IS THEIR VALUE TO THE CUSTOMER?

*Moderator: Faith Lambert, U.S. Department of Energy*

#### PAPERS:

##### **Custom NEBs: Are They Worth It? - Experiences, Challenges, and Directions in Massachusetts**

Jeremy Newberger, National Grid  
Nick Hall, TecMarket Works  
Johna Roth, TecMarket Works  
Paul Horowitz, PAH Associates  
David Weber, NSTAR Electric and Gas Corporation

##### **Exploring the Application of Conjoint Analysis for Estimating the Value of Non-Energy Impacts**

Nicole Wobus, Summit Blue Consulting  
Jennifer Meissner, New York State Energy Research and Development Authority  
Brent Barkett, Summit Blue Consulting,  
Don Waldman, University of Colorado  
Kenneth Train, University of California, Berkeley, CA  
Jennifer Thacher, University of New Mexico  
Daniel Violette, Summit Blue Consulting, Boulder, CO

##### **Using NEBs to Attract “Ordinary” Homeowners to Energy Efficiency:**

###### **The New Zealand Case**

Lisa A. Skumatz, Ph.D., Principal, Skumatz Economic Research Associates, Inc. (SERA)  
Albrecht Stoecklein, BRANZ, Porirua, New Zealand

#### SESSION SUMMARY:

In many cases over the years it seems that the non-energy benefits (NEBs) associated with various energy efficiency and renewable energy programs have been as important to program participants as the energy and cost savings achieved, and sometimes even more so. Some customers place significant value on improved comfort levels, noise abatement, health improvements, environmental benefits, and the like. The papers in this session describe different methods of measuring the importance of NEBs to program participants in Massachusetts, New York, and New Zealand.

The first paper, “Custom NEBs: Are They Worth It?,” describes several years of effort in Massachusetts to estimate the NEBs realized from commercial and industrial custom energy efficiency projects. It reviews the challenges experienced in applying an initial approach, the study and decision to move to a different approach, the details of that prospective/retrospective approach, and the early experiences with the new two-part approach, including preliminary findings.

The second paper, “Exploring the Application of Conjoint Analysis for Estimating the Value of Non-Energy Impacts,” explores a range of methods for valuing non-energy impacts, discussing the benefits and constraints of each approach. The paper then describes the use over several years of two methods, direct query and conjoint analysis, in analyzing a set of energy efficiency programs carried out by the New York Energy Research and Development Administration. This paper concludes with recommendations on how best to apply these methods to future programs.

The third paper in the session, “Using NEBs to Attract “Ordinary” Homeowners to Energy Efficiency: The New Zealand Case,” presents the results of an analysis of NEBs associated with three

energy efficiency building and retrofit programs in New Zealand. An island country with limited usable resources, New Zealand is also a developed country facing strong population and natural consumption growth. As such, it is critical for New Zealand that energy, water and other natural resources be used wisely and conserved as much as possible. This paper explores the value homeowners placed on a range of NEBs and presents quantitative results which are being used to target and market residential programs, and in barrier and benefit-cost analysis.

# **Custom NEBs: Are They Worth It? - Experiences, Challenges, and Directions in Massachusetts**

*Jeremy Newberger, National Grid, Northborough, MA  
Nick Hall and Johna Roth, TecMarket Works, Oregon, WI  
Paul Horowitz, PAH Associates, West Simsbury, CT  
David Weber, NSTAR Electric and Gas Corporation, Westwood, MA*

## **ABSTRACT**

This paper is the first public presentation of the context and past experience in Massachusetts with estimating non-electric benefits (NEBs) from commercial and industrial custom energy efficiency projects. It reviews the challenges experienced in applying an initial approach, the study and decision to move to a different approach, the details of that prospective/retrospective approach, and the early experiences with the new two-part approach, including preliminary findings.

# Exploring the Application of Conjoint Analysis for Estimating the Value of Non-Energy Impacts<sup>1</sup>

*Nicole Wobus, Summit Blue Consulting, Boulder, CO*

*Jennifer Meissner, New York State Energy Research and Development Authority, Albany, NY*

*Brent Barkett, Summit Blue Consulting, Boulder, CO*

*Dr. Don Waldman, University of Colorado, Boulder, CO*

*Dr. Kenneth Train, University of California, Berkeley, CA*

*Dr. Jennifer Thacher, University of New Mexico, Albuquerque, NM*

*Dr. Daniel Violette, Summit Blue Consulting, Boulder, CO*

## Abstract

As energy efficiency program spending continues to increase, refining the methodologies used to value associated non-energy impacts (NEIs) has taken on greater interest and importance.<sup>2</sup> This paper discusses limitations of the most widely used approaches to estimate the value of NEIs experienced by program participants and examines an alternative method.

The value of “hard-to-measure” NEIs, such as comfort, are primarily assessed based on feedback from program participants. Virtually all previous studies have either asked respondents to directly estimate their willingness-to-pay (WTP) for NEIs (referred to as contingent valuation), or have used various scaling techniques in which respondents’ WTP is estimated based on their comparison of the value of NEIs to the value of project energy savings. Both approaches possess limitations. Most notably, they require respondents to directly consider the value of NEIs in dollar terms.

Conjoint analysis may be used to address these limitations.<sup>3</sup> Conjoint analysis survey instruments present individuals with hypothetical scenarios that force respondents to make tradeoffs and exercise “real-world” decision-making. WTP for NEIs is then calculated based on respondents’ choices. In addition to providing a more realistic context for respondent preferences than other methods, conjoint analysis yields more comprehensive data on respondent preferences, and it limits the potential for gaming. However, the conjoint method also has limitations.

This paper examines the range of methods for valuing NEIs. Benefits and constraints of each approach are discussed, and results are presented in the context of one program administrator’s multi-year application of these methods. This paper also discusses how best to apply these methods in the future.

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<sup>1</sup> The views expressed in this paper are those of the authors and do not necessarily reflect the views of the New York State Energy Research and Development Authority.

<sup>2</sup> While non-energy impacts are also sometimes referred to as “non-energy benefits” this paper discusses both positive and negative impacts of energy efficiency measures, and therefore, uses the term non-energy impacts.

<sup>3</sup> The paper will focus on a form of CA that uses “choice experiments” as opposed to a system of ranking attributes.

# Using NEBs to Attract “Ordinary” Homeowners to Energy Efficiency: The New Zealand Case

*Lisa A. Skumatz, Ph.D., Principal, Skumatz Economic Research Associates, Inc. (SERA), Superior, CO  
Albrecht Stoecklein, BRANZ, Porirua*

## **ABSTRACT**

Household energy consumption depends both on activities and, to a high degree, the choice of technology used / installed in our homes. In many situations, energy-efficiency (EE) measures are associated with energy cost savings. However, these technologies also bring significant other potential benefits related to the natural environment and lifestyle. These issues tend to be more significant decision drivers to consumers than energy savings, but valuing and comparing these non-financial benefits is inherently difficult.

The new century is seeing a worldwide trend towards achieving a sustainable environment and eco-societies. New Zealand is an island country with limited usable resources and is also a developed country facing strong population and natural consumption growth. Given the resulting pressures placed on energy, housing, water, and the environment, the project was designed to quantify factors that influence program decision-making, and provide an opportunity to most effectively market programs that reduce the energy-related burdens on the environment.

The evaluation included a new home construction program, a weatherization program, and an insulation-retrofit program. The Non-energy benefits (NEBs) associated with each program differed – both in the most highly valued NEBs and the level of value compared to the program’s projected savings. Highly valued benefits included improvements in comfort, bill control, health, noise, maintenance and the environment. Both positive and negative impacts were investigated to identify the net value that the occupant placed on the outcomes. The results suggest that most residents place a much higher value on the lifestyle benefits from energy-efficiency features of their homes than on energy savings. The paper presents these quantitative results, which are being used in program targeting, and marketing of program homes, barriers analysis, and benefit-cost analysis.

## SESSION 5E

### **SPILOVER AND NET-TO-GROSS: PURSUING ACCURATE EVALUATION OF ENERGY EFFICIENCY PORTFOLIO RESULTS**

*Moderator: Rafael Friedmann, Pacific Gas and Electric Company*

#### PANELISTS:

Kenneth Keating, BPA  
Mike Rufo, Itron Consulting, Inc.  
Larry Parkenas, NYSERDA  
Valerie Richardson, PG&E Co.

#### SESSION SUMMARY:

Assessing accurately the energy savings resulting from the increasingly multi-dimensional energy-efficiency portfolios and increasingly mature markets in which they operate is becoming very difficult. The increasingly mature energy-efficiency market is even finding itself hard-pressed to deliver the energy-efficiency goods and services being demanded by customers, public officials, and corporate entities intent on riding the “Green” bandwagon wave. Optimizing how public resources are used to take advantage, foster, and leverage private actions will require more than ever, the careful evaluation of the net savings impacts resulting from specific interventions or portfolios of these given the increased interest, resources, and role energy efficiency is expected to play to mitigate climate change impacts and reduce socio-political tensions from our energy use.

A key concept in determining the net energy savings impacts from a specific intervention (or portfolio of these) is the Net-to-Gross (NTG) ratio, which endeavors to correct gross savings impacts observed by subtracting what would have happened under a business-as-usual scenario. The NTG ratio seeks to both estimate free riders (those who would have taken action absent the intervention) and spillover or free drivers (actions taken by both participants and non-intervention participants as a result of the intervention beyond the direct impacts of it). In the past, when few customers had been “touched” by energy-efficiency program interventions and there was no energy-efficiency market infrastructure, evaluation methods existed to estimate NTG with some degree of confidence. Currently there is a growing concern and agreement among evaluation practitioners, policymakers, and portfolio implementers that NTG estimates are uncertain and the methods for estimating it in dire need of revamping. Indeed, even the applicability of the NTG concept in today’s context is suspect. Yet portfolio implementers and overseers need to be able to estimate the cost-effectiveness of the measures, interventions and strategies being used to optimize resources to maximize future energy savings results.

The panel draws from the California, Northwest and New York experiences to describe how each of these arenas is struggling with the continued application of the NTG concept. Panelists will also propose ideas on how to improve current methods so as to be able to improve the accuracy of net savings estimates and optimize energy-efficiency portfolio offerings.



## SESSION 6A

### PEAKING INTEREST IN ENERGY EFFICIENCY

*Moderator: Maureen McNamara, U.S. Environmental Protection Agency*

#### PAPERS:

##### **Estimating Peak Demand Impacts of Energy Efficiency Programs: A National Review of Practices and Experience**

Dan York, Ph.D., American Council for an Energy-Efficient Economy  
Marty Kushler, Ph.D., American Council for an Energy-Efficient Economy  
Patti Witte,

##### **Overview of the Evaluations of California's 2004-2005 Efficiency Programs**

Nick Hall, Carmen Best, Johna Roth, TecMarket Works  
Peter Lai, California Public Utilities Commission  
Pete Jacobs, Architectural Engineering  
Lori Megdal, Megdal and Associates

##### **Integrating Demand Side Resource Evaluations in Resource Planning – An Industry Turning Point**

Daniel M. Violette, Summit Blue Consulting  
Rachel Freeman, Summit Blue Consulting, LLC

#### SESSION SUMMARY:

With more than a decade of delivering energy efficiency programs in some parts of the country, the industry has developed a great deal of experience in evaluating the kWh benefits of energy efficiency programs, and demonstrating that energy efficiency can deliver substantial results. Many utilities across the country currently are faced with a potential need for significant generation and infrastructure investments at a time of uncertainty regarding future carbon regulation and escalating costs for traditional supply resources. Energy efficiency offers a cost-effective solution to delaying or avoiding some investments with its potential to curb energy consumption overall as well as reduce demand during peak hours. This session will focus on how energy efficiency programs are accounting for peak demand benefits, as well as explore potential changes to resource planning processes that could improve how supply-side planners integrate demand-side resources in their planning framework to mitigate costs and risks.

The first paper “Estimating Peak Demand Impacts of Energy Efficiency Programs: A National Review of Practices and Experience,” presents results from a national review of current practices for estimating demand impacts from energy efficiency programs. A particular focus of the project was to review a set of existing databases and related technical references to examine reported energy and demand impacts for a set of common energy efficiency measures included in programs. The authors found a surprising lack of actual ex-post measurement of demand savings from energy efficiency programs and that most of the references for estimating demand impacts of energy efficiency measures were based on assumptions about load factors and shapes, not necessarily actual field-measured results.

The second paper, “Overview of the Evaluations of California's 2004-2005 Efficiency Programs” summarizes findings to date from an ongoing effort to review the evaluations of the over 200 energy efficiency programs that are funded through the California public goods charge (PGC). The

paper presents the evaluation approaches being used to address the California Public Utility Commission's evaluation requirements, as well as overarching findings and recommendations from the process and impact evaluations completed thus far. Studies reviewed in the paper demonstrate that the 75 percent of the kW savings predicted by program implementers are being delivered and that somewhat less than half of the programs are accurately projecting the impacts that they can achieve.

The third paper "Integrating Demand Side Resource (DRS) Evaluations in Resource Planning – An Industry Turning Point" explores the importance of planning approaches that addresses risk management across both supply-side and demand-side resources – including the role that DSR can play in managing resource cost risks – and advocates for a direct incorporation of DSR in resource planning processes. A case study is used to illustrate issues.

# **Estimating Peak Demand Impacts of Energy Efficiency Programs: A National Review of Practices and Experience**

*Dan York, Ph.D. and Marty Kushler, Ph.D., American Council for an Energy-Efficient Economy, Madison, WI and Lansing, MI; and Patti Witte, Lansing, MI.*

## **Abstract**

From their inception in the late 1970s, electric energy efficiency programs have tended to focus primarily on saving energy (kilowatt-hours). While energy efficiency programs can and often do produce reductions in peak demand (kilowatts), that typically has not been as much of a priority. Over the past few years, however, there has been a renewed and rapidly growing interest in drawing upon the peak demand impacts of energy efficiency programs to improve system reliability and avoid costlier new investments in generation or transmission and distribution systems.

This paper presents results from a national review of current practices for estimating demand impacts from energy efficiency programs. A particular focus of the project was to review a set of existing databases and related technical references to examine reported energy and demand impacts for a selected representative set of common energy efficiency measures included in programs.

We found a surprising lack of actual ex-post measurement of demand savings from energy efficiency programs. As a proxy for the availability of impact evaluations that include some type of actual ex-post measurement of peak demand savings, we searched IEPEC and ACEEE Summer Study conference proceedings from 1994 through 2006 for relevant conference papers that reported such results. Overall we found relatively few such examples. Most of the conference papers we found that reported demand impacts derived such impacts from the estimated energy savings using load shapes or load factors. Our review and analysis of protocols and databases used by selected state and utility energy efficiency programs confirms this finding; most of the references for estimating demand impacts of energy efficiency measures are based on assumptions about load factors and shapes, not necessarily actual field-measured results.

# **Overview of the Evaluations of California's 2004-2005 Efficiency Programs**

*Nick Hall, Carmen Best, Johna Roth, TecMarket Works, Oregon, WI  
Peter Lai, California Public Utilities Commission, Los Angeles, CA  
Pete Jacobs, Architectural Engineering, Boulder, CO  
Lori Megdal, Megdal and Associates, Acton, MA*

## **Abstract**

In 2004-2005 California fielded over 200 energy efficiency programs funded through the public goods charge (PGC). These programs included statewide, local utility and third-party implementation efforts. Each program was to be evaluated according to the California Public Utility Commission's (CPUC's) Energy Efficiency Policy Manual and CPUC approved evaluation plans. A total of 100 independent evaluations will be completed for the program cycle. This paper presents the evaluation approaches used to address the CPUC's evaluation objectives, some of the issues addressed by the various studies, the activities used to address those issues, the evaluated program effects, and overarching findings and recommendations from the process and impact evaluations. In summary, the studies included in this paper demonstrate that the 75 percent of the kW savings predicted by the program implementers is being delivered to the state of California and that somewhat less than half of the programs are accurately projecting the impacts that they can achieve. The methods used to predict energy savings from energy efficiency programs needs to be reexamined to make the process more accurate. Process evaluations need to focus more attention on making programs more effective at capturing their energy impact objectives.

# **Integrating Demand Side Resource Evaluations in Resource Planning – An Industry Turning Point**

*Dr. Daniel M. Violette, Summit Blue Consulting, LLC, Boulder, CO  
Rachel Freeman, Summit Blue Consulting, LLC, Boulder, CO*

## **Abstract**

The electric and gas industry is at a crossroads in its view of Demand-Side Resources (DSR). The costs of traditional approaches to meeting future energy needs may no longer be economic or acceptable due to fundamental changes in fossil fuel markets, environmental concerns, and the large investments needed for industry infrastructure. This investment includes generation, transmission, and fuel supply infrastructure (e.g., gas pipelines and rail lines). In addition, sizeable compliance costs associated with carbon mitigation and other environmental requirements are likely to increase in the future. The risks of pursuing traditional energy supply strategies have never been higher, and demand-side activities can have an important role in managing the risks associated with the cost of energy (i.e., reasonable rates) and its availability.

This paper extends work being done on integrating DSR within resource planning processes. This paper focuses on:

- The importance of planning approaches that address risk management across both supply-side and demand-side resources – including the role that DSR can play in managing resource cost risks.<sup>1</sup> A recent review of utility resource plans found that none of the plans “explicitly analyzed the risk-mitigation benefits of demand-side resources.”<sup>2</sup>
- A dynamic planning process that considers the timing and sizing of DSR investments in resource portfolios. This moves the resource evaluation process away from static benefit-cost tests and towards the direct incorporation of DSR in planning assessments which can appropriately address important attributes of DSR including the flexibility of DSR.

A case study is used to illustrate issues in and some conclusions from looking at a select set of DSR resources in a supply plan with a focus on DR and pricing programs.

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<sup>1</sup> This certainly is not the first time this issue has been addressed. Hirst (1992) used sensitivity, scenario, and worst-case analysis methods to address uncertainty in two resource portfolios. His research indicated that it was feasible to analyze the effects on uncertainty of including DSM programs in a utility’s resource mix. He recommended that “utilities, which to date have done very little such analysis, should conduct such studies as part of their integrated-resource planning activities.”

<sup>2</sup> Two of the five key findings in this recent review of utility resource planning processes included: 1) “In most resource plans, energy-efficiency effects were implicit, or fixed, in the modeling process. Few utilities explicitly modeled energy efficiency as a resource, allowing it to compete with supply-side resources in identifying a least-cost portfolio;” and 2) While utilities have made significant progress in analyzing alternative resource portfolios under different risk scenarios, “none explicitly analyzed the risk-mitigation benefits of energy-efficiency resources.” See Nicole Hopper, Charles Goldman, and Jeff Schlegel (2006), which examined the most recent resource plans for 14 utilities in the West.

## SESSION 6B

### IT'S NOT YOUR FATHER'S MODEL ANYMORE: INNOVATIVE IMPACT EVALUATION METHODS

*Moderator: Robert Wirtshafter, Wirtshafter Associates, Inc.*

#### PAPERS:

##### **A Matter of Size: Using Ordinary Least Squares to Estimate Energy Savings Savings in the Commercial Sector**

Hossein Haeri, Quantec, LLC,  
Matei Perussi, Quantec, LLC,  
Iris Sulyma, BC Hydro,

##### **Eliminating the Guesswork: The Information-Theoretic Approach to Model Selection**

Kathryn Parlin, West Hill Energy and Computing, Inc.  
Larry Haugh, University of Vermont

##### **The Gift that Keeps Giving: A Structured Approach Measuring Participant Spillover**

Christopher Dyson, KEMA Inc.  
Miriam Goldberg KEMA Inc.

#### SESSION SUMMARY:

This session first presents two innovative impact evaluation models using fixed effects models. The first looks at the implications of heteroscedasticity when applied to fixed effects models. The second examines the information-theoretic approach based on Akaike's Information Criterion as an effective tool for model selection. A third paper looks at a structural approach for measuring participant spillover.

The Haeri paper is about the application of regression analysis for assessing savings in the commercial sector. Using data from BC Hydro's Power Smart Partners Program, it demonstrates the effects of large variances in annual consumption on parameters derived by Ordinary Least Squares (OLS) and the accompanying problem of *heteroscedasticity*. Using visual inspection of data and statistical tests, the paper examines the presence and extent of heteroscedasticity and applies two alternative methods to correct for the problem: 1) assigning a unique intercept to each facility (fixed-effects model); and 2) by transforming all to deviations from individual facility means (deviation model).

The Parlin paper introduces a new approach for deciding model specification. The Akaike's Information Criterion is an information-theoretic method for model selection. The paper introduces the concept, explores the strengths and weaknesses of this approach in comparison to other model selection techniques and provides a step-by-step description of how to implement this approach. The author gives an example of how to use the Akaike's Information Criterion using a fixed effects billing analysis conducted for a low income retrofit program, based on a pooled, cross-sectional, time series data set. Although the example is from an impact evaluation, the potential applications of this methodology extend to many other types of evaluations, including, but not limited to, market characterizations, process evaluations and attribution studies.

The Dyson paper discusses a comprehensive approach for measuring participant spillover. The paper describes how they approached the various challenges of a self-report participant spillover methodology including: finding the right decision-maker, avoiding double-counting, estimating program

attribution, estimating spillover savings, and recording other indicators of market effects. The paper also summarizes the levels of participant spillover savings and other market effects that was found. Finally the paper discusses both the advantages and disadvantages of this approach.

# **A Matter of Size: Using Ordinary Least Squares to Estimate Energy Savings in the Commercial Sector**

*Hossein Haeri, Ph.D. and Matei Perussi, Quantec, LLC, Portland, OR  
Iris Sulyma, BC Hydro, Vancouver, B.C.*

## **ABSTRACT**

Regression analysis is one of the most common statistical techniques used for measurement and verification of savings from energy-efficiency programs. Using panel data (cross-sectional time series), evaluators have used regression models to derive estimates of gross and/or net savings in a variety of research designs and specifications. This paper is about the application of regression analysis for assessing savings in the commercial sector. Using data from BC Hydro's Power Smart Partners Program, it demonstrates the effects of large variances in annual consumption on parameters derived by Ordinary Least Squares (OLS) and the accompanying problem of *heteroscedasticity*. Using visual inspection of data and statistical tests, the paper examines the presence and extent of heteroscedasticity and applies two alternative methods to correct for the problem: 1) assigning a unique intercept to each facility (fixed-effects model); and 2) by transforming all to deviations from individual facility means (deviation model). The results show both models' specifications are effective means of correcting for the problem, though, depending on the heterogeneity of the participant population, some tolerable degree of heteroscedasticity may remain. The one disadvantage of the fixed-effects model is that, by incorporating unique intercepts for each facility, it significantly limits the degrees of freedom.



# **Eliminating the Guesswork: The Information-Theoretic Approach to Model Selection**

*Kathryn Parlin, West Hill Energy and Computing, Inc.  
Larry Haugh, University of Vermont*

## **Abstract**

This paper briefly covers the theoretical underpinning of the information-theoretic method for model selection, explores the strengths and weaknesses of this approach in comparison to other model selection techniques and provides a step-by-step description of how to implement this approach. This process is then illustrated by applying these concepts to a billing analysis conducted for a low income retrofit program, based on a pooled, cross-sectional, time series data set. Although the example is related to impact evaluation, the potential applications of this methodology extend to many other types of evaluations, including, but not limited to, market characterizations, process evaluations and attribution studies.

# **The Gift That Keeps Giving: A Structured Approach for Measuring Participant Spillover**

*Christopher Dyson KEMA Inc.*

*Miriam Goldberg KEMA Inc.*

## **ABSTRACT**

This paper describes a structured approach for measuring participant spillover. We developed this methodology after: 1) reviewing past approaches for measuring participant spillover to identify best practices; and 2) refining the methodology through practical experience measuring participant spillover for the Wisconsin Focus on Energy Business Programs. The paper describes how we approached the various challenges of a self-report participant spillover methodology including: finding the right decision-maker, avoiding double-counting, estimating program attribution, estimating spillover savings, and recording other indicators of market effects. The paper also summarizes the levels of participant spillover savings and other market effects that we found. Finally the paper discusses both the advantages and disadvantages of this approach.

## SESSION 6C

### COLD CASE: METHODS AND EVIDENCE FOR EVALUATION REFRIGERATOR RECYCLING

*Moderator: Bobbi Tannenbaum, KEMA Inc.*

#### PAPERS:

##### **How Electric Customers Dispose of Used Refrigerators and Why They Choose a Utility Program**

Steven Westberg, Hiner & Partners  
John H. Reed, Innovologie, LLC  
Charles Bailey, Innovologie, LLC  
Moria Morrissey, Innovologie, LLC  
Don Dohrmann, ADM and Associates  
John Peterson, Athens Research  
Shahana Samiullah, Southern California Edison

##### **Gross Savings Estimation for Appliance Recycling Programs: The Lab Versus In Situ Measurement Imbroglio and Related Issues**

John Peterson, Athens Research  
Don Dohrmann, ADM and Associates  
Taghi Alereza, ADM and Associates  
Shahana Samiullah, Southern California Edison  
Steven Westberg, Hiner & Partners  
John H. Reed, Innovologie, LLC

##### **Net Savings Estimation in Appliance Recycling Programs: A Review and Empirical Analysis with Recent California Data**

Donald R. Dohrmann, ADM Associates  
John Peterson, Athens Research  
John H. Reed, Innovologie LLC  
Shahana Samiullah, Southern California Edison Company  
Steven Westberg, Hiner and Partners

#### SESSION SUMMARY:

This session explores three issues related to refrigerator recycling programs: customer appliance disposal choices; gross savings estimates, and net-to-gross analysis. This rare session provides a comprehensive look at multiple evaluation issues related to a single program type, with data consistent in time, geography and program parameters.

All three papers are based on research conducted as part of the evaluation of the 2004-2005 California statewide Residential Appliance Recycling Program (RARP). The California market and RARP program provide an excellent venue for research and results that are applicable to recycling programs throughout the nation. The market is large — approximately 700,000 refrigerator units disposed of annually and almost 100,000 program recycled units in 2005. In addition, the RARP program has a history of evaluation that builds upon previous approaches and findings.

The first paper, “How Electric Customers Dispose of Used Refrigerators and Why They Choose a Utility Program,” discusses the used appliance market and disposal choices available to customers. The authors use a combination of primary and secondary data, both qualitative and quantitative, to

develop a comprehensive flow diagram of refrigerator disposal in California. The authors also discuss customer preferences for disposal methods and reasons for participating in the recycling program.

The second paper, “Gross Savings Estimation for Appliance Recycling Programs: The Lab Versus In Situ Measurement Imbroglio and Related Issues,” addresses the differences between lab and in-situ metering of appliances. This issue is important for estimating per unit energy consumption (UEC), the foundation upon which program gross savings are based. Previous evaluations are based on DOE protocol based tests data (lab metering) and participating unit characteristics to determine population unit energy consumption. While estimating program gross savings, the paper also addressed the difference between lab-based UEC estimates and *in situ* metering-based UEC. The paper reports on analysis performed on a data from a dual metering study in which 200 units were metered in-situ and DOE-tested by BR Labs. The authors discuss the myriad factors that may cause differences, including whether there are systematic lab-in situ differences in the recycling population as well as issues such as extrapolating short term metering to annual consumption. The results, although preliminary, point to some systematic differences between in-situ and lab metered consumption estimates and recommends important elements for continued evaluation of the program.

The third paper, “Net Savings Estimation in Appliance Recycling Programs: A Review and Empirical Analysis with Recent California Data,” discusses the net-to-gross (NTG) ratio approach used to evaluate the RARP program. The authors repeat the 2002 program evaluation data collection and analysis approach and apply it to the 2004-2005 program. They discuss the approach and suggest modifications to some of the assumptions supported by market data collected in this study. Later in this paper the authors reevaluate the conceptual underpinnings of the approach and propose an alternative view akin to direct measurement of free-ridership regarding program recycled units that would have been transferred to another user in the absence of the program. Using the old approach, the modified assumption approach, and an approach reflecting the alternative view, the resulting NTG ratios for the 2004-2005 RARP range from 0.409 to as high as 0.68 (all higher than the 0.351 for the 2002 program.) The difference in results reflects the volatility of the NTG ratios over program populations, market data, and approved methodologies.

# How Electric Customers Dispose of Used Refrigerators and Why They Choose a Utility Program

*Steven Westberg, Hiner & Partners*  
*John H. Reed, Innovologie, LLC*  
*Charles Bailey, Innovologie, LLC*  
*Moria Morrissey, Innovologie, LLC*  
*Don Dohrmann, ADM and Associates*  
*John Peterson, Athens Research*  
*Shahana Samiullah, Southern California Edison*

## Abstract

Many utilities are operating appliance recycling programs as part of their demand-side management programs. While there have been many evaluations of these programs, there is generally a lack of information about used appliance markets and the disposal choices that are available to customers that can directly inform both program planning and evaluation for these programs. Based on evaluation data (Dohrmann 2007) from the Residential Appliance Recycling Program (RARP) that was implemented statewide by California investor-owned utilities (IOUs), this paper presents a description of the paths that used refrigerators take when they leave customer's homes and provides an analysis of how customers choose among disposal options. Approximately 12 percent of refrigerators pass through the RARP. About 11 percent are sold and another 24 percent are given away. Dealers receive about 25 percent. Twenty-two percent are taken to recycle. The destination of 6 percent is unknown. When refrigerators are given away they are mostly given away to family and friends (19 out of 24 percent) with the remainder going to charities. Many charities no longer take refrigerators. More than half of the used refrigerators that are sold are sold to friends or family. We estimate that about five percent are for sale through advertisements. The percentage of refrigerators going to dealers that are actually resold appears to be less than five percent. A percentage is being shipped out of the US. Approximately, a third of used refrigerators are non-working.

When choosing between the utility program and other alternatives, consumers are primarily seeking a convenient, no cost method of disposal. Hauling a refrigerator or freezer to a landfill or keeping it are methods of last resort. Receiving a payment for their unit matters to some consumers (this is a key reason to choose the utility program), though others are relatively indifferent to receiving payment as long as they do not have to pay for disposal. What happens to the unit is another consideration. Some consumers prefer that their unit gets used by someone else (e.g., a friend or neighbor) while others find recycling more appealing. Fast pickup is what matters most. Same day pickup is most appealing, followed by 3 days, and then 7-14 days.

# Gross Savings Estimation for Appliance Recycling Programs: The Lab Versus In Situ Measurement Imbroglio and Related Issues

*John Peterson, Athens Research*  
*Don Dohrmann, ADM and Associates*  
*Taghi Alereza, ADM and Associates*  
*Shahana Samiullah, Southern California Edison*  
*Steven Westberg, Hiner & Partners*  
*John H. Reed, Innovologie, LLC*

## Abstract

Estimates of gross savings for California appliance recycling programs have relied upon methods relating DOE test and characteristic data from multi-era sample of refrigerators and freezers (R/F) to the program population (Athens Research 1996, 1998; KEMA, 2004). The result is a *reliable* approach that yields lab-based program population unit energy consumption (UEC) estimates for the evaluated program and for plausible scenarios involving change in program focus. And yet, skepticism about the external *validity* of this approach prevailed throughout the same decade: do lab-based regression estimates reflect the actual *in situ* consumption of the R/F? If there are systematic *lab-in situ* differences in the recycling population, is this relationship *contingent* upon other variables? *Related* issues include: extrapolation to full year UEC given error in short term in situ metering; degradation, and the factors *other than age* that *select for* a recycling population that is characterized by performance problems; the major physical determinants of differences between in situ and laboratory tests.

This paper reports on both data development and analysis relating to:

- extension of the lab data regression/population UEC estimation method to the 2004-05 IOU's recycling program,
- incorporation of a small dually metered sample (ADM, 2006) as a basis for investigating and preliminarily establishing the "lab-in situ relationship(s)",
- evidence on key issues: extrapolation from short term metering to full year consumption, the level of performance problems typical of recycling appliance populations, and
- summary analysis on the causal determinants of differences between lab and in situ results.

# **Net Savings Estimation in Appliance Recycling Programs: A Review and Empirical Analysis with Recent California Data**

*Donald R. Dohrmann, ADM Associates, Inc., Sacramento, CA*

*John Peterson, Athens Research, Pasadena, CA*

*John H. Reed, Innovologie LLC, Rockville, MD*

*Shahana Samiullah, Southern California Edison Company, Irwindale, CA*

*Steven Westberg, Hiner and Partners, Long Beach, CA*

## **Abstract**

The net-to-gross (NTG) ratio has a powerful but often poorly understood influence on the overall savings impacts of energy efficiency programs in general and appliance turn-in programs in particular. In California, KEMA, Inc. (previously XENERGY) developed an influential general approach to estimating net savings for appliance recycling programs. This paper addresses issues related to using that approach for the estimation of net savings for appliance recycling programs. Historical and recently developed data collected for an evaluation of appliance recycling programs in California have been used to examine the approach. These survey data were used to replicate, supplement, and re-evaluate the approach developed by KEMA for estimating net savings. The expanded sample sizes for non-participants as well as participants have been used to analyze inter-utility and participation mode (primary, secondary refrigerator, or freezer) variations in NTG ratios.

## SESSION 6D

### MARKETING AND SOCIAL MARKETING FOR ENERGY EFFICIENCY

*Moderator: Monica Nevius, Consortium for Energy Efficiency*

#### PAPERS:

##### **Making the Intangible Tangible: How to Evaluate a Social Marketing Campaign**

Sharyn Barata, Opinion Dynamics Corporation

Chris Anderson, Opinion Dynamics Corporation

##### **Measuring the Effects of Marketing Campaigns: Lessons and Innovative Methods from California**

Jennifer Mitchell-Jackson, Opinion Dynamics Corporation

Sharyn Barata, Opinion Dynamics Corporation

Nick Hall, TecMarket Works

Peter Lai, California Public Utilities Commission

#### SESSION SUMMARY:

This session will focus on both core and cutting-edge research methods for evaluating energy-efficiency marketing and social marketing campaigns. Two papers are included in this session.

The first paper, “Making the Tangible Intangible: How to Evaluate a Social Marketing Campaign,” describes the theoretical background on which social marketing program evaluation approaches should be based, and lays out the elements necessary for the robust evaluation of energy-efficiency social marketing campaigns. In addition to the key elements needed for any social marketing campaign evaluation, the authors describe three optional methods—trade-off analysis, intensity measures, and past behavior indices—that can improve the quality and scope of these evaluations, including benefits and drawbacks of each. The authors draw on their extensive experience evaluating social marketing campaigns to illustrate examples of each of the approaches addressed in the paper.

The second paper, “Measuring the Effects of Marketing Campaigns: Lessons and Innovative Methods from California,” discusses the lessons learned from the evaluation of three statewide California marketing and outreach campaigns, *Flex Your Power*, *Reach for the Stars*, and *UTEEM*. The paper describes four challenges to measuring the effects of marketing and outreach campaigns revealed by the evaluation, and introduces a series of innovative tools for measuring these effects that are applicable to the evaluation of any marketing and outreach campaign. To help evaluators better assess the viability of these innovative methods for their own campaign evaluation work, the authors concisely summarize what each of the methods is and is not capable of accomplishing.



# **Making the Intangible Tangible: How to Evaluate a Social Marketing Campaign**

*Sharyn Barata, Opinion Dynamics Corporation, Laguna Niguel, CA  
Chris Anderson, Opinion Dynamics Corporation, Cambridge, MA*

## **Abstract**

Across the country evaluators are being asked to determine the likelihood that energy efficiency marketing efforts not only raise awareness, but also result in customers adopting more energy efficient practices. Funders of energy efficiency marketing campaigns are also asking implementers to consider social marketing approaches when developing their campaigns —as the external environment for promoting energy efficiency has opened the door for alternative marketing approaches.

This paper illustrates the core research methods that allow us to both confidently predict the success of a particular marketing effort before committing the funds to undertake the effort, and to evaluate the effectiveness of a marketing effort after implementation. In the past, many research studies measuring the success of an energy efficiency marketing effort simply asked respondents to indicate whether they were likely to undertake a particular energy efficient practice or purchase a particular piece of energy efficient equipment. The answers to these questions were often used to predict behaviors and to measure the impact of programs. This practice still occurs even though these answers are now known to not necessarily reflect the actual intentions of the respondent. This paper provides a better methodology for understanding and predicting actual behaviors and for measuring program effectiveness. A more effective approach for measuring likely behavior change allows the energy efficiency community to make sounder decisions regarding the funding of programs and marketing efforts.

## **Measuring the Effects of Marketing Campaigns: Lessons and Innovative Methods from California**

*Jennifer Mitchell-Jackson, Opinion Dynamics Corp, Houston, TX*

*Sharyn Barata, Opinion Dynamics Corp, Laguna Niguel, CA*

*Nick Hall, TecMarket Works, Madison, WI*

*Peter Lai, California Public Utilities Commission, Los Angeles, CA*

### **Abstract**

Prior to the 2006-2008 program cycle, California's Marketing and Outreach (M&O) programs were seen as marketing campaigns for educational purposes, and thus were not subject to the same evaluation efforts as resource acquisition programs. Because the majority of the California Public Utility Commission's (CPUC's) evaluation efforts focused on programs that directly achieve energy savings, marketing campaigns such as *Flex Your Power* had not been evaluated. However, not evaluating these programs also meant that to some extent, California's M&O programs were unaccountable to the CPUC, which funded these efforts. In this paper the authors describe California's recent move towards establishing metrics for these M&O programs so that they can start to define and determine "success." This paper discusses four challenges related to measuring the effects of M&O efforts based on lessons learned in California. The authors highlight five innovative tools that the CPUC is considering for measuring effects, and discuss the applicability of these five methods to M&O programs in other areas of the country.

## SESSION 6E

### ENERGY EFFICIENCY AND DEMAND RESPONSE – SEPARATE EFFORTS OR TWO ENDS OF A CONTINUUM?

*Moderator: Ingrid Rohmund, Energy Insights*

#### PANELISTS:

Bruce Evans, CPS Energy

Steve Braithwait, Christensen Associates Energy Consulting, LLC

Mike Alexander, PG&E

#### SESSION SUMMARY:

Increasingly, policymakers and utilities are looking to both energy efficiency (EE) and demand response (DR) as ways to balance customers' needs for electricity and the efficient operation of power generation and delivery. Programs related to both efforts are proving effective in the marketplace, but issues can arise when EE and DR interact. Since the value of these programs is driven primarily by the savings, either across all hours for EE or in specific peak hours for DR, conflicts between the two efforts threaten to thwart the success of both types of programs.

In this Panel Discussion, we will present the situation and the issues and problems that can arise. We will then discuss how alternative views of these efforts may help to clarify the benefits of both EE and DR in an environment where both are present. We believe that it does not serve anyone's interest to have programs fight with each other for credit for savings, which has happened in the industry. By understanding the interplay between EE and DR, the industry can more efficiently promote both efforts, and appropriately represent the benefits of each.

Examples of specific questions the panel will address are:

- How do DR and EE “fit” together?
- Is there a hierarchy or protocol that includes EE and DR? What else falls into this hierarchy, and where?
- How can the industry account for the “cross-effects” of EE and DR, where programs provide benefits in both areas?
- How are efforts and rules in various jurisdictions helping or hurting this situation?
- What are the issues around the interaction of EE and DR from the customer perspective? How do customers view offerings in these arenas?
- How can we deal with competition for savings between programs using a broader view of the benefits, and avoid short-sightedness?
- What is the impact of self-generation on EE, DR, and the interplay between the two?
- How can an integrated view of the EE/DR continuum help all programs succeed?

The panel represents a cross-section of the industry perspectives on this issue.

- Moderator **Ingrid Rohmund** is a **Practice Director** for Energy Insights. With a background in both economics and customer research, she leads the Customer and End-Use Research practice area for Energy Insights. With detailed knowledge of Energy Insight's (and organizational predecessors Primen and EPRI Solutions) extensive utility customer research efforts, she brings the customer perspective on EE and DR to the panel.
- **Bruce Evans** is **Director, Strategic Energy Mgmt & Client Solutions** at CPS Energy in San Antonio, Texas. Bruce brings the perspective of a utility with renewed emphasis on Demand Response and a tradition of Energy Efficiency.
- **Steve Braithwait** is a **Vice President** at Christensen Associates Energy Consulting. He specializes in competitive retail pricing with an emphasis on the measurement of customer price response, as well as the evaluation of customer product and provider preferences. Dr. Braithwait brings an economist's perspective to the panel, having studied response to price-based DR at various utilities across the country.
- **Mike Alexander** is **Manager of Demand Response Programs** at PG&E. He brings the perspective of a veteran utility that has had both EE and DR active for years, under an actively involved Commission. Mike also has a lengthy experience across many diverse areas of PG&E.

## SESSION 7A

### WORLD WIDE VIEW: POTENTIAL ENERGY SAVINGS STUDIES

*Moderator: Marygrace Cerce, KeySpan Energy Delivery*

#### PAPERS:

##### **Building a Better Mousetrap: A Unique Approach to Determining Reliable Savings Potential**

Glenn C. Haynes, PE, RLW Analytics, Inc., Middletown, CT

Thomas Ledyard, RLW Analytics, Inc., Middletown, CT

Gail Azulay, NSTAR Electric and Gas, Westwood, MA

Ralph Prah, Prah and Assoc., Madison, WI

##### **DSM Potential Evaluation for Long-term Resource Planning in Korea**

Chang-Ho Rhee, Ki-Seon Cho, Jong-Jin Park

Korea Electrotechnology Research Institute

##### **Electric Efficiency Potential Down-Under: New Zealand in Perspective**

Bobbi Tannenbaum, KEMA, Madison, WI

Fred Coito, KEMA, Oakland, CA

Michael Ting, Itron, Oakland, CA

Steven Meyers, Rational Energy Network, Austin, TX

Elizabeth Hicks, KEMA, Burlington, MA

Andrew Stevenson, Electricity Commission of New Zealand, Wellington

#### SESSION SUMMARY:

Different approaches from three countries that present studies of potential energy savings. One study focuses on electric savings in all sectors, another focuses on electric, oil and gas savings in the residential sector and the third on long-term resource planning.

# **Building a Better Mousetrap: A Unique Approach to Determining Reliable Savings Potential**

*Glenn C. Haynes, PE, RLW Analytics, Inc., Middletown, CT  
Thomas Ledyard, RLW Analytics, Inc., Middletown, CT  
Gail Azulay, NSTAR Electric and Gas, Westwood, MA  
Ralph Prah, Prah and Assoc., Madison, WI*

## **Abstract**

Estimation of remaining energy savings potential is an important step in determining energy efficiency resource allocation for any state or region. The high cost of obtaining customer-specific choices, however, often leads researchers to base these estimates on top-down approaches that utilize assumptions and high level inputs to characterize complex behavioral activities and perceptions regarding customer choices.

An innovative bottom-up approach was implemented in one New England state by RLW Analytics and participating utility companies to estimate statewide market potential based on direct customer responses to information and questions regarding their own economically feasible potential conservation measures.

# **DSM Potential Evaluation for Long-term Resource Planning in Korea**

*Chang-Ho Rhee, Ki-Seon Cho, Jong-Jin Park*  
*Korea Electrotechnology Research Institute*  
*Uiwang, Gyeonggi, 437-808, KOREA*

## **ABSTRACT**

DSM programs focusing on peak demand reduction in Korea have been implemented and at present time, try to reduce 4,000 MW amounting to 7% of 54,631 MW peak demand in 2005. The long-term power development plan is going to raise the goal of DSM program peak reduction to 11,000MW, 13% level of peak demand in 2020. Most of the DSM programs were focused on reduce peak demand in summer period using interruptible and voluntary programs. The current peak cutting programs consist of traditional billing incentive program and DLC for large customer. The latter is expected fundamental change in DSM programs during wholesale competition. In addition, this program initiated by government at the first stage will be moving towards DSM bidding in the electricity market during improvement of competition. The Korean government focus on maintain supply adequacy and mitigate price volatility in electricity market. So the DSM programs which obtaining demand-side resource are set as a priority of electricity policy. The key factors in DSM programs are evaluation of peak load potential by program during resource planning period. Most of peak load programs target cover large customer in commercial and industrial sector. At first, this paper suggest to approach analyze on demand resource assessment by end-use and identify achievable load potential by measures before implementation. And we estimate program potential during peak load period for the customer by several end-use like HVAC, lighting, driver, inverter, pump etc. And then we forecast DSM resource by suggesting methodologies by program during horizon years. Finally, we suggest the implementation process and DSM goal setting mechanisms considering program portfolio and cost effectiveness under constraints like supply option, budget etc.

# **Electric Efficiency Potential Down-Under: New Zealand in Perspective**

*Bobbi Tannenbaum, KEMA, Madison, WI*

*Fred Coito, KEMA, Oakland, CA*

*Michael Ting, Itron, Oakland, CA*

*Steven Meyers, Rational Energy Network, Austin, TX*

*Elizabeth Hicks, KEMA, Burlington, MA*

*Andrew Stevenson, Electricity Commission of New Zealand, Wellington*

## **Abstract**

The New Zealand Electricity Commission is responsible for regulating the country's electricity industry and for promoting electric energy efficiency and conservation. The Commission funded a study to identify the potential for electric energy efficiency in all sectors, over a 10 year planning period, and to develop programme designs for implementation of continuing national energy efficiency efforts. This paper is based on the preliminary results from that study.

The paper starts by providing an overview of the New Zealand electricity industry. We discuss the basic approach and terminology used to identify efficiency potential. We discuss consumption characteristics and then focus on the economic potential for electric energy efficiency in New Zealand. Throughout the paper we discuss characteristics specific to New Zealand, including those that affect identifying the efficiency potential and in realizing energy efficiency savings through programs.



## SESSION 7B

### ADVANCES IN UNDERSTANDING APPLIANCE MARKETS

*Moderator: Shel Feldman, Shel Feldman Management Consulting*

#### PAPERS:

##### **Seeing There Without Being There: Results of Using the Internet to Assess Appliance Availability in Retail Stores**

Thomas Mauldin, Nexus Market Research

Lynn Hoefgen, Nexus Market Research

Angela Li, National Grid

##### **Impact of Energy Prices and Energy Efficiency Activities on Sales of ENERGY STAR® Appliances in California**

K. H. Tiedemann, BC Hydro

##### **Bounce-Back from ENERGY STAR® Specification Changes in the Appliance Market in the Northeast US: A Regression Analysis**

Seth E. Snell, Ph.D., Applied Proactive Technologies, Inc.

#### SESSION SUMMARY:

Assessing the availability of energy-efficient appliances in retail stores is an important component of the evaluation of appliance programs, and this factor is discussed in our first paper, “Seeing There Without Being There: Results of Using the Internet to Assess Appliance Availability in Retail Stores.” Surveying the inventory stock at a large number of retail stores can be time-consuming and expensive. This paper discusses the results of an approach to assessing retail availability that uses the Internet as a cost-effective alternative for collecting data on a large number of models at stores located in different regions.

Market transformation programs create new challenges and opportunities for program evaluators. In our second paper, “Impact of Energy Prices and Energy Efficiency Activities on Sales of ENERGY STAR® Appliances in California,” the study develops and applies an interrupted time-series model, using quarterly sales data for the period 1998-2003, to measure market transformation in the California markets for refrigerators, clothes washers and dishwashers. There are three main conclusions. First, an increase in electricity price is associated with increases the sales of ENERGY STAR qualifying refrigerators, clothes washers and dishwashers. Second, the additional energy efficiency activities that were launched following the 2001 California energy crisis were followed by an increase in the sales of ENERGY STAR refrigerators, clothes washers and dishwashers. Third, the energy savings for the three appliances were substantial.

Our final paper, “Bounce-Back from ENERGY STAR® Specification Changes in the Appliance Market in the Northeastern US: A Regression Analysis,” examines the drop-off in availability of qualifying equipment and the bounce-back recovery time associated with ENERGY STAR specification changes for the major appliances. The study looked at sales floor inventory information from retailers throughout the Northeastern United States. This is an important issue because technology changes, which are frequent in an emerging market, can have major effects on expected program outcomes. The EPA, the DOE, and their ENERGY STAR partners have undertaken various strategies to prevent the drop in available ENERGY STAR products following a specification change, with limited success.

Linear regression analyses of the proportion of models on sales floors that are ENERGY STAR qualified, across retailers throughout the region, shows that the drop off is least and bounce-back the quickest for clothes washers, and largest and most prolonged for room air conditioners. This study also provides a forecast of the availability of ENERGY STAR models in the Northeastern US.

# **Seeing There without Being There: Results of Using the Internet to Assess Appliance Availability in Retail Stores**

*Thomas Mauldin and Lynn Hoefgen, Nexus Market Research, Cambridge, MA  
Angela Li, National Grid, Northborough, MA*

## **ABSTRACT**

Assessing the availability of energy-efficient appliances in retail stores is an important component of the evaluation of appliance programs. However, conducting stocking inventories at a large number of retail stores can present a time-consuming and expensive proposition. This paper discusses the results of an approach to assessing retail availability that uses the Internet as a cost-effective alternative for collecting data on a large number of models at stores located in different regions. This analysis should serve as an indicator of the model availability encountered by consumers who visit selected retail stores.

This study assessed the availability of ENERGY STAR and Consortium for Energy Efficiency (CEE) Tier 1, 2, and 3 clothes washers, dishwashers, refrigerators, and room air conditioners during the spring of 2006 at Best Buy and Sears stores located in and near Cambridge, Massachusetts, compared with the availability in and near Sacramento, California, Tampa, Florida, and Rochester, New York. Greater availability of CEE Tier 2 and Tier 3 models in Massachusetts than in other locations would be consistent with the stores' expectations of higher sales of those models. This was in fact the case with clothes washers, suggesting that the Massachusetts ENERGY STAR Appliance program, which began providing \$100 incentives in 2006 to customers who purchase Tier 3 models, has been successful in encouraging stores to stock the most energy-efficient clothes washer models. However, the stocking levels of high-efficiency dishwashers, refrigerators, and room air conditioners is similar at the Massachusetts stores compared to the stores located elsewhere.

This type of Internet analysis should provide valuable insight in understanding appliance markets and planning programs.

# **Impact of Energy Prices and Energy Efficiency Activities on Sales of ENERGY STAR<sup>®</sup> Appliances in California**

*K. H. Tiedemann, BC Hydro, Vancouver, BC*

## **Abstract**

Market transformation programs create new challenges and opportunities for program evaluators. On the one hand, traditional evaluation techniques such as use of pre/post comparisons with treatment and control groups may not be possible if the treatment group is potentially the whole population, but on the other hand, econometric techniques, such as the interrupted time-series model, can potentially deal with confounding market effects in a comprehensive and credible manner. This study develops and applies the interrupted time-series model to measure market transformation in the California markets for refrigerators, clothes washers and dishwashers using quarterly sales data for the period 1998-2003. This study has three main conclusions. First, an increase in electricity price increases the sales of ENERGY STAR qualifying refrigerators, clothes washers and dishwashers. Second, additional energy efficiency activities launched following the 2001 California energy crisis increased the sales of ENERGY STAR refrigerators, clothes washers and dishwashers. Third, the combined first year reductions in energy consumption for the three appliances were 12.03 GWh in 2002 and 24.06 GWh in 2003 using ordinary least squares regression models, and 11.87 GWh in 2002 and 23.74 GWh in 2003, using maximum likelihood regression models.

# **Bounce Back from ENERGY STAR® Specification Changes in the Appliance Market in the Northeast US: A Regression Analysis**

*Seth E. Snell, Ph.D., Applied Proactive Technologies, Inc., Springfield, MA*

## **Abstract**

Periodically, ENERGY STAR® specifications for products are updated to reflect technological advances and to maintain the standard that all ENERGY STAR products are the most energy efficient products in the U.S. marketplace. Substantial drops in the availability of ENERGY STAR products following appliance specification changes have been common and may generate confusion in the marketplace especially in regions where rebates are offered for ENERGY STAR qualified products (Karney, 2006). The EPA, DOE, and its ENERGY STAR partners have undertaken various strategies to prevent the drop in available ENERGY STAR products following a specification change, with limited success. This paper addresses the extent of drop-off and the bounce back recovery time in ENERGY STAR availability associated with specification changes in the major appliances by analyzing sales floor inventory information from retailers throughout the Northeastern United States. Linear regression analyses of the fraction of models on sales floors that are ENERGY STAR qualified through time and across retailers throughout the region provide the analytical framework from which to estimate the bounce back time for each appliance and retailer type. The drop off is least and bounce back the quickest for clothes washers during this time period. The largest and most prolonged drop in the availability of ENERGY STAR models following a specification change is observed for room air conditioners. This research also generates estimates of the growth in the availability of ENERGY STAR models on northeastern sales floors by appliance and retailer type.

## SESSION 7C

### **PROGRAM EFFICIENCY, INSTALLATION QUALITY AND PEAK LOAD IMPACTS: NEW PERSPECTIVES IN RESIDENTIAL HVAC EVALUATION**

*Moderator: David Hungerford, California Energy Commission*

#### PAPERS:

##### **Savings Uncertainties in Residential Air Conditioning Rebate Programs**

Rachel Freeman, Summit Blue Consulting

##### **Do Quality Installation Verification Programs for Residential Air Conditioners Make Sense in New England?**

Robert M. Wirtshafter, Wirtshafter Associates

Greg Thomas, Performance Systems Development

Gail Azulay, NSTAR

William Blake, National Grid

Ralph Prah, Prah and Associates

##### **Measuring the Load Impact of an Air Conditioner Cycling Program**

Ed Lovelace, Southern California Edison

Corina Jump, Itron Inc.

Kris Bradley, Itron Inc.

#### SESSION SUMMARY:

This session focuses on the problem of evaluating peak impacts of residential AC programs. The papers represent three different evaluation approaches to estimating peak impacts from three different AC program types.

The first paper, “Savings Uncertainties in Residential Air Conditioning Rebate Programs” describes the development and application of a methodology for estimating the range of uncertainty on savings from residential AC efficiency programs. Results from this paper show that efficiency rating uncertainty and operating conditions outside of design specifications can increase demand saving estimate errors by a factor of 2.5. Key performance uncertainties identified include duct leakage, refrigerant charge, unit sizing, air flow over the coil, and extreme operating conditions. The model, Crystal Ball®, uses sensitivity analysis to identify and prioritize input uncertainties having the greatest contribution to kW and kWh savings, and thus provide program managers and evaluators with a tool for designing cost-effective programs and developing data collection plans.

The second paper, “Do Quality Installation Verification Programs for Residential Air Conditioners Make Sense in New England?”, examines the peak impacts of programs intended to encourage and provide tools to HVAC technicians to test and correct air flow and refrigerant charge conditions on existing systems. It finds that the investment in this type of program is only feasible for systems having extra capacity at system peaks.

The third paper, “Measuring the Load Impact of an Air Conditioner Cycling Program” reports the results of an analysis of end use data collected from a sample of Southern California Edison’s “Air Conditioner Cycling Summer Discount Program”. It estimates baseline usage and load reduction impacts for a variety of temperature conditions. Hourly impact estimates by temperature allow resource

planners to more precisely estimate the resource value of the AC cycling program and helps program staff more effectively manage the program.

# Savings Uncertainties in Residential Air Conditioning Rebate Programs

*Rachel Freeman, MS, Summit Blue Consulting, LLC, Boulder, CO*

## ABSTRACT

This study presents a methodology for estimating the range of uncertainty on savings from residential AC efficiency programs. This analysis involves building a Crystal Ball<sup>1</sup> model that includes all the performance and data uncertainties that can affect actual savings gained in the field. Sensitivity charts produced by the model show which input uncertainties contribute the most to the uncertainty in kW and kWh savings. They also provide pointers to program evaluators about which aspects of the program should be prioritized for data verification.

This method can help program designers to establish program parameters for requirements such as minimum EER/SEER standards and whether to include minimum installation standards, by looking at the minimum savings needed to make the program cost-effective and the predicted savings for different SEER levels. It can also be useful when making field data collection plans.

The model run for this study used “generic” values for most of the parameters. These would have to be redefined for the particular program being modeled. The inputs should reflect the actual uncertainties present in the program being implemented. For this study, the model showed that:

- Uncertainty in EER and operating conditions mean that demand savings could be up to 2.5 times lower or almost two times higher than predicted; in some cases, they can be negative.
- Uncertainty in energy savings is much lower than uncertainty in demand savings.
- Sensitivity charts show that if EER is not known, it is the variable with the most contribution to variance in demand savings, and that EFLH contributes the most to variance in energy savings.

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<sup>1</sup> Crystal Ball software is a product of Decisioneering Inc ([www.decisioneering.com](http://www.decisioneering.com))



# **Do Quality Installation Verification Programs for Residential Air Conditioners Make Sense in New England?**

*Robert M Wirtshafter, Wirtshafter Associates, Inc, Rydal, PA*  
*Greg Thomas, Performance Systems Development, Ithaca, NY*  
*Gail Azulay, NSTAR, Westwood MA*  
*William Blake, National Grid, Westwood, MA*  
*Ralph Prahl, Prahl & Associates, Madison, WI*

## **Abstract:**

Many New England utilities have instituted Quality Installation Verification Programs (QIV) to improve the efficiency of residential air conditioning (AC) systems by encouraging HVAC technicians to use third-party software to test the air flow and refrigerant charge conditions of AC systems they install or service. The QIV approach recognizes that many existing systems and new installations do not achieve the maximum efficiency because the refrigerant charge and air flow are not at the levels recommended by the equipment's manufacturer. The QIV programs provide incentives to technicians who use either the Honeywell Service Assistant (HSA) or the CheckMe tools to test system conditions.

This paper examines the results of programs in New England focused on encouraging HVAC firms to use the QIV testing approach when installing or servicing AC systems. This paper discusses whether the QIV tests save energy and avoid peak demand and whether there are other AC systems initiatives that deserve more attention in New England.

The paper finds that Quality Installation Verification Programs cannot be justified unless the AC systems have extra capacity at system peak. If systems have insufficient capacity, efficiency gains produced by air flow and refrigerant charge correction will not reduce peak demand. The undercapacity of air conditioners at peak appears to happen in many of the homes included in the 2002 base line assessment conducted by a group of New England utilities by RLW Analytics and in on-sites performed in 2006 on homes receiving a high efficiency air conditioner.

# Measuring the Load Impact of an Air Conditioner Cycling Program

*Ed Lovelace, Southern California Edison  
Corina Jump, Kris Bradley, Itron, Inc.*

## **Abstract**

During the summer of 2005 Southern California Edison (SCE) initiated an evaluation of its Air Conditioner Cycling Summer Discount Program. The evaluation captured and analyzed extreme (hot weather data-influenced) AC usage during California's record-breaking heat storm in the summer of 2006. System-wide baseline AC usage and cycling impacts by time of day and outdoor temperature were generated for weekday and weekend days. The results can be used by program staff and utility planners to model program impacts based on a variety of participation patterns and weather conditions.

## SESSION 7D

### OVERCOMING THE BARRIERS TO INTRODUCING NEW PRODUCTS

*Moderator – Elizabeth Hicks, KEMA, Inc*

#### PAPERS:

**Raising the Temperature on Lighting: Acceptance and Energy Savings Potential Utilizing Spectrally Enhanced Lighting**

Brian Liebel, AfterImage+Space

**Put Another Nickel In - Market Opportunities for Energy Star Vending Machines Overcoming the Barriers of Leased Equipment**

Shawn Shaw, The Cadmus Group, Inc.

Jim Mapp, Wisconsin Division of Energy

Kate Lewis, US EPA Energy Star

Barbara Smith, Wisconsin Division of Energy

John Schott, The Cadmus Group

**Product Selection - A Forgotten Vital Component of Program Design**

Nikhil Gandhi, Strategic Energy Technologies, Inc.

Floyd Keneipp, Summit Blue Consulting

Dulane Moran, Research Into Action, Inc.

Jane Peters, Research Into Action, Inc.

Shahana Samiullah, Southern California Edison

Anne West, Quantec, LLC

#### SESSION SUMMARY:

This session explores the challenges of bringing new energy efficiency products into markets. Energy efficient products must overcome many barriers to be successfully introduced into the market. Evaluation and market research can help to overcome these barriers. The Liebel paper deals with the challenges experienced in customer acceptance of new lighting technologies. It also presents the savings potential from these new technologies. The Shaw paper presents the challenges of customer adoption in the leased equipment market and what that means for program design. The technology addressed in this paper is vending machines. The Gandhi paper identifies some pitfalls of ignoring non-energy saving characteristics of products selected in an innovative utility program. These other benefits can be used in marketing the program.

# **Raising the Temperature on Lighting: Acceptance and Energy Savings Potential Utilizing Spectrally Enhanced Lighting**

*Brian Liebel, PE, AfterImage +Space*

## **Abstract**

Over the last 20 years, research on Spectrally Enhanced Lighting (SEL) has demonstrated that under light sources with relatively higher Correlated Color Temperatures (CCT) and with the same illuminance levels, pupil size is reduced, brightness perception is increased, and visual acuity is improved. As an energy saving strategy, lighting installations with higher CCT lamps can therefore be designed at lower illuminance levels using less energy because of the compensatory effects that the higher CCT lamps provide, without risk of reduced visual performance. SEL therefore has the potential to provide substantial energy savings and peak demand reduction in commercial buildings through the use of fewer lamps, lower ballast-factor ballasts, and/or fewer luminaires. While the products used in SEL installations are immediately available and cost no more than standard lighting equipment, industry acceptance has not been widespread due primarily to the perception that building occupants would reject relatively higher CCT lighting. This paper provides the scientific background of SEL and details the most recent field studies performed by the US Department of Energy (DOE) that have demonstrated both energy savings and occupant acceptance of SEL. Moreover, this paper demonstrates how the use of this lighting method can realistically permanently reduce the electric lighting load by approximately 25% as compared to standard T8/electronically ballasted lighting and 50% as compared to T12/magnetically ballasted lighting. Finally, the paper concludes that SEL installations have immediate payback for new installations and no more than a 4-year payback for lighting retrofit installations.

# **Put Another Nickel In: Market Opportunities for ENERGY STAR Vending Machines Overcoming the Barriers of Leased Equipment**

*Shawn Shaw, The Cadmus Group, Watertown, MA  
Jim Mapp, Wisconsin Div. of Energy, Madison, WI  
Kate Lewis, US EPA ENERGY STAR, Washington D.C.  
Barbara Smith, Wisconsin Div. of Energy, Madison, WI  
John Schott, The Cadmus Group, Watertown, MA*

## **ABSTRACT**

Vending machines are an untapped resource for energy savings. The national stock of 3.2-4 million vending machines consumes about 12 billion kWh annually, more than the State of Delaware. Despite this opportunity, the efficiency community has had only a limited suite of options to capture these savings.

In this paper, the authors will examine:

**Lessons learned from past and current vending machine programs:** Programs to date have focused on aftermarket control devices, generally installed by the host site. In some cases, these programs have met with limited success, resulting in low persistence and/or reliability of energy savings.

**Potential energy and demand savings of ENERGY STAR qualified vending machines:** ENERGY STAR vending machines use efficient components (e.g. T-8 lighting and ECM motors) to cut energy use by 40-50% compared to standard models.

**Barriers to market penetration of ENERGY STAR:** Despite high savings, the market penetration of ENERGY STAR vending machines remains low. The major market barriers are a low sales/stock ratio and a split incentive between machine owners (equipment costs) and host sites (energy costs).

**New Opportunities to Save Energy:** As of August 2006, machine owners may refurbish existing vending machines to meet ENERGY STAR requirements. These retrofits reduce the incremental cost barrier while addressing the persistence issues of previous aftermarket control-based programs.

Based on the authors' extensive experience in working with the national ENERGY STAR program, regional efficiency organizations, and the vending market, this evaluation will provide program managers with the necessary tools to implement, manage, and evaluate a cost-effective energy efficiency/DSM program promoting ENERGY STAR vending machines.

## **Product Selection—A Forgotten Vital Component of Program Design**

*Nikhil Gandhi, Strategic Energy Technologies, Inc., Acton, Massachusetts*

*Floyd Keneipp, Summit Blue Consulting, Walnut Creek, California*

*Dulane Moran, Research Into Action, Inc., Portland, Oregon*

*Jane Peters, Research Into Action, Inc., Portland, Oregon*

*Shahana Samiullah, Southern California Edison, Irwindale, California*

*Anne West, Quantec, LLC., Portland, Oregon*

### **Abstract**

Energy efficiency programs promote technologies that have reported energy and demand savings, which is a primary qualifying consideration. Other technology characteristics such as the appropriateness of application, maintenance and repair considerations, customer comfort, functionality and ease of use under different operating conditions, durability, and appearance do not get as much scrutiny as energy savings. As a result, expected energy savings can fail to materialize or customers lose confidence, jeopardizing technology acceptance.

Two separate products, operating on the same principle, were selected to control air conditioner usage when the controlled area was unoccupied. One product was targeted for small hotels/motels and another for multifamily homes. The results of on-site verification found a failure rate of up to 90 percent in multifamily housing. In the case of a third product, an emerging lighting technology was chosen for retrofit application in niche markets. Despite initial challenges, the lamps appeared to fit well in outdoor applications. However, the technology did not have the range of brightness or color temperature expected for indoor applications, where the lamps “made everything look green.”

These findings were unexpected, and discussions with facility personnel showed that the design of selected products was inappropriate for the application without further development and the selected products did not offer the claimed benefits under all operating conditions. This paper identifies some pitfalls of ignoring non-energy-saving characteristics of products; discusses the reasons for lack of performance; and reasserts the need to return to the basics of technology assessments to ensure savings persistence.

## SESSION 7E

### CAN ENERGY EFFICIENCY DELIVER FOR THE GRID?

*Moderator: Maureen McNamara, U.S. Environmental Protection Agency*

#### PANELISTS:

Ken M. Keating, Ph.D.  
Phil Mosenthal, Optimal Energy  
Stephen Cowell, Conservation Services Group

#### SESSION SUMMARY:

Energy efficiency is a cost-effective resource that delivers a number of societal benefits including lowering energy bills, moderating utility prices, delivering environmental benefits, creating jobs and improving state economies, and improving energy security. Energy efficiency has been proven to be a reliable resource in some parts of the country in reducing demand growth, particularly in areas of the country such as the Pacific Northwest and New England that have had supportive policies and energy efficiency programs in place for many years. Given efficiency's track record in delivering results, it is increasingly being relied upon as a least cost resource for avoiding or delaying the need to build new power plants, particularly given regulatory uncertainty surrounding potential future climate change regulation. With this expanding use of energy efficiency as a utility system resource, there has also been re-vitalized interest in the use of energy efficiency as an alternative to transmission and distribution investments.

Can energy efficiency and related resource options such as combined heat and power deliver relief to congestion zones or help avoid or delay the need for new transmission and distribution (T&D) investments—in theory yes, especially if planned for in advanced and targeted (or cited near) constrained geographic areas. A few areas of the country have moved beyond theory and are beginning to target energy efficiency resources for this purpose. For example, recent Vermont legislation directed the Vermont Public Service Board (PSB) to develop a new transmission planning process so that all resources including energy efficiency can be considered and treated in a transparent and unbiased way. A complementary order issued by Vermont PSB, directed the energy efficiency utility, Efficiency Vermont, to increase energy efficiency targets in the state and to target efficiency investments in strategic ways to address transmission congestion and system reliability needs. In addition, for a number of years, Bonneville Power Administration (BPA) has undertaken collaborative efforts to examine “nonwires” solutions to transmission investments in the Pacific Northwest and has been able to delay transmission investment in the Olympic Peninsula through a combination of energy efficiency and demand response initiatives. Panel members will discuss the role of energy efficiency in avoiding or delaying the need for transmission and discuss how some jurisdictions are overcoming barriers to greater use of efficiency as a resource in this context. Panelists will discuss questions such as:

- What institutional barriers are there to convincing utility executives and transmission planners that energy efficiency and CHP resources are a reliable alternative to certain T&D investments?
- How do you know that you've got a MW with energy efficiency?

- How are costs and risks evaluated differently for energy efficiency vis-à-vis transmission investments? What is the best way to compare energy efficiency to other alternatives that have different characteristics?
- How far in advance do energy efficiency and CHP resources need to be pursued in order to offer a valid alternative to T&D investments? What conditions affect how quickly efficiency can be deployed?
- How do regulators view energy efficiency as an alternative to T&D investment? What needs to be done to educate regulators about the role of efficiency in delivering system reliability?
- Are there regulatory or other policy barriers that have limited consideration of energy efficiency in transmission planning? How and where are states working to overcome these barriers?
- When is energy efficiency not a solution for avoiding T&D investment?



## SESSION 8A

### EVALUATING THE NEW

*Moderator: Philipp Degens, Energy Trust of Oregon*

#### PAPERS:

##### **Evaluating Emerging Technologies Programs: Accelerating the Future**

Jonathan Holz, ECONorthwest, Portland, OR

Steve Grover, ECONorthwest, Portland, OR

Carol Yin, Southern California Edison, Irwindale, CA

##### **An Evaluation Framework for a Portfolio of Research, Development & Demonstration Programs**

Helen Kim, New York State Energy Research & Development Authority

Larry Pakenas, New York State Energy Research & Development Authority

Rick Ridge, Ridge & Associates

Scott Albert, GDS Associates

Gretchen Jordan, Sandia National Laboratories

##### **Leveraging For-Profit Businesses to Increase Non-Profit Energy Efficiency: Findings From Oregon's Business Energy Tax Credit Program**

John Boroski, ECONorthwest, Portland, OR

Stephen Grover, ECONorthwest, Portland, OR

Suzanne Dillard, Oregon Department of Energy, Salem, OR

#### SESSION SUMMARY:

Evaluation of programs focused on new and developing technologies often require different evaluation techniques and methods. This session presents three evaluations; two focusing on methods for evaluating programs of emerging technologies, some that are in early development phases, and one focusing on the expansion of energy efficiency tax incentives to the non-profit sector. The session will look at how emerging technologies and services can be evaluated, especially in their early stages of development where less is known of their energy benefits and cost effectiveness. Appropriate metrics for assessing products and evaluation methods will be discussed. Additionally the session will look at an approach to evaluating program innovations in the area of energy efficiency project financing for the non-profit sector.

The first paper - *Evaluating Emerging Technologies Programs: Accelerating the Future* - looks at an information-only program that seeks to accelerate the introduction of innovative energy efficient technologies. A comprehensive process evaluation focuses on the two complementary components of the evaluation; the development of the logic model and case studies. Case studies are in conjunction with the logic model to evaluate program.

The second paper - *An Evaluation Framework for a Portfolio of Research, Development & Demonstration Programs* - provides an approach to evaluate a large diverse portfolio of research, development and demonstration (RD&D) programs that are in different phases of the product development cycle. Performance criteria are identified for use in evaluating projects that go beyond looking at energy benefits. A peer review process was implemented to assess the significance of the accomplishments.

The final paper in the session – *Leveraging For-Profit Businesses to Increase Non-Profit Energy Efficiency: Findings From Oregon’s Business Energy Tax Credit Program* – looks at innovations at a unique state energy efficiency tax incentive program that allow entities with no tax liability to participate, especially those in the non-profit sector.

# **Evaluating Emerging Technologies Programs: Accelerating the Future**

*Jonathan Holz, ECONorthwest, Portland, OR*

*Steve Grover, ECONorthwest, Portland, OR*

*Carol Yin, Southern California Edison, Irwindale, CA*

## **Abstract**

The California Statewide Emerging Technologies Program (ETP) is an information-only program that seeks to accelerate the introduction of innovative energy efficient technologies, applications, and analytical tools that are not widely adopted in California. The ETP works to accelerate a product's market acceptance through a variety of approaches, but mainly by reducing the performance uncertainties associated with new products and applications. This is done primarily through technology assessments, where technologies are tested in a controlled environment in an effort to confirm manufacture claims regarding equipment performance and savings potential. The current program is being implemented by the four California investor-owned utilities (Pacific Gas and Electric, Southern California Edison, Southern California Gas, and San Diego Gas and Electric).

A comprehensive process evaluation was conducted for the 2004-2005 program cycle of the ETP. Although the evaluation focuses on the 2004-05 program, it was also designed to meet the new California protocols that will be used for the 2006-08 program evaluation cycle. This paper will focus on the two complementary components of the evaluation; the development of the logic model and case studies. Specifically, this paper will present the functional logic model that was developed as part of the evaluation, and describe how case studies were used to highlight successful links in the logic and evaluate the progress of the ETP.

# **An Evaluation Framework for a Portfolio of Research, Development & Demonstration Programs**

*Helen Kim, New York State Energy Research & Development Authority*  
*Larry Pakenas, New York State Energy Research & Development Authority*  
*Rick Ridge, Ridge & Associates*  
*Scott Albert, GDS Associates*  
*Gretchen Jordan, Sandia National Laboratories*

## **Abstract**

This paper addresses an approach used to evaluate a portfolio of research, development and demonstration (RD&D) programs administered at the State level. The following project types were identified: (1) research for policy, including environmental research, (2) product development, (3) demonstrations, and (4) pre-deployment activities. In addition, the following performance criteria were identified for use in evaluating projects: (1) knowledge creation, (2) knowledge dissemination, (3) commercialization progress, (4) energy benefits, (5) economic benefits, and (6) environmental benefits. Data were assembled to measure progress of projects according to these criteria and compiled into an “accomplishments packet” consisting of quantitative and qualitative information. The packet was distributed to peer reviewers to assess the significance of the accomplishments. The results of the assessment are discussed. The applicability of the approach to the various types of projects and technologies is also presented.

# **Leveraging For-Profit Businesses to Increase Non-Profit Energy Efficiency: Findings From Oregon's Business Energy Tax Credit Program**

*John Boroski, ECONorthwest, Portland, OR*

*Stephen Grover, ECONorthwest, Portland, OR*

*Suzanne Dillard, Oregon Department of Energy, Salem, OR*

## **Abstract**

The Oregon Department of Energy Business Energy Tax Credit Program was created in 1979 as an incentive for businesses to invest in energy conservation, renewable energy resources, recycling, and less polluting transportation fuels. Under the program, business owners can file a 35 percent tax credit for certified project costs over a 5-year period. In 2001, ODOE added a Pass-through Option to allow non-profit organizations, schools, tribes, public entities and others without a tax liability to participate. The Option allows for any energy project owner, with or without a tax liability, to transfer or "pass-through" their tax credit eligibility to a business partner (with a tax liability) willing to accept the tax credit in exchange for cash payment. Since 2001, completed Pass-through projects have achieved annual energy savings of over 4,000,000 MMBtus and over 1,500 projects have been matched with partners.

This paper presents key findings from an evaluation of the Pass-through Option. These findings were derived from an analysis of program data, a phone survey of energy project owners, and in-depth interviews with a range of experienced program actors. The evaluation results will be of interest to other jurisdictions that are seeking ways to increase energy efficiency investment in the non-profit sector and to evaluators of similar programs.

## SESSION 8B

### PLANNING WITH WHAT WE KNOW AND WHAT WE DON'T KNOW - ASSESSING AND MANAGING UNCERTAINTY AND RISK IN PORTFOLIO CONSTRUCTION AND EVALUATION

*Moderator: Nick Hall, TecMarket Works*

#### PAPERS:

##### **Energy Efficiency Portfolio Risk Management: A Systematic, Data-Driven Approach for Timely Interventions to Maximize Results**

Richard Ridge, Ridge & Associates  
Steve Kromer, Teton Energy Partners  
Steven Meyers, Rational Energy Network  
Doug Mahone, Heschong Mahone Group, Inc.  
Jay Luo, Pacific Gas and Electric Company  
Valerie Richardson, Pacific Gas and Electric Company  
Rafael Friedmann, Pacific Gas and Electric Company  
Nick Hall, TecMarket Works

##### **Multi-Criteria Decision Analysis: Managing Uncertainties in Program Energy Savings Cost-Effectively**

Hossein Haeri, Quantec, LLC  
Derek Henriques and Iris Sulyma, BC Hydro

##### **Optimizing DSM Program Portfolios**

William B. Kallock, Summit Blue Consulting  
Daniel Violette, Summit Blue Consulting

#### SESSION SUMMARY

Assessing portfolios of programs to pick programs that have the highest potential to capture savings is a challenging job. Trusting the program's projected savings is not enough, because the program's projected savings may never be captured. This session examines approaches for addressing uncertainties in portfolio planning in order to minimize risk of low savings and maximize the potential for high savings. During this session three different assessment/evaluation approaches will be presented.

The first paper describes the use of Monte Carlo simulations to identify which programs have the greatest probability of under or over performing. This approach was first used by the California PUC to determine how to allocate \$70 million worth of evaluation resources. Following this effort, PG&E used a similar approach to assess which programs offer the highest potential for meeting the company's energy savings goals.

The second paper uses the Analytic Hierarchy Process (AHP) to assess the real program performance risks from multiple perspectives. This process uses AHP "pair-wise" approaches to evaluate the relative importance of various risk factors that can be expected to affect the performance of a program or portfolio of programs.

The final paper demonstrates the use of Modern Portfolio Management Theory to design and offer programs that offer the greatest return of savings within a portfolio investment strategy. This paper

will present how portfolio management methods used in the financial community can be modified to identify portfolio of programs that have the highest performance potential.

# **Energy Efficiency Portfolio Risk Management: A Systematic, Data-Driven Approach for Timely Interventions to Maximize Results**

*Richard Ridge, Ridge & Associates, Alameda, CA*  
*Steve Kromer, Teton Energy Partners, Oakland, CA*  
*Steven Meyers, Rational Energy Network, Austin, TX*  
*Doug Mahone, Heschong Mahone Group, Inc., Fair Oaks, CA*  
*Jay Luo, Pacific Gas and Electric Company, San Francisco, CA*  
*Valerie Richardson, Pacific Gas and Electric Company, San Francisco, CA*  
*Rafael Friedmann, Pacific Gas and Electric Company, San Francisco, CA*  
*Nick Hall, TecMarket Works, Oregon, WI*

## **ABSTRACT**

A systematic, data-driven approach is being used to maximize the net benefits of Pacific Gas and Electric Company's portfolio of energy efficiency programs. The analysis centers on identifying and minimizing riskier elements affecting portfolio performance and allowing informed optimization of resources. Given the recent tripling in funding and the stretch energy saving goals established for the 2006-2008 period, an approach providing actionable results for timely corrections to the portfolio implementation is needed.

This paper describes an approach for identifying, quantifying, and managing risk that maximizes the probability that PG&E will meet its energy and demand savings targets. The keystone of our systematic risk management approach is Monte Carlo simulation using Crystal Ball (CB) software. CB automatically calculates thousands of different "what if" cases, saving the inputs and results of each calculation as individual scenarios. Analyzing these scenarios reveals the range of possible outcomes, their probability of occurring, which inputs have the most effect on your model results and where program managers should focus their activities to manage risk.

This paper provides concrete examples of how both primary and secondary data have been used to modify various parameters (e.g. net-to-gross ratios, installed units) that adjust the forecast and assess the probability of not achieving the energy and demand targets. The simulation results guide the selection of actionable strategies to manage this risk. Continuous monitoring of key portfolio performance indicators (e.g. installation counts and levelized cost) help determine the success of each particular strategy.



# **Multi-Criteria Decision Analysis: Managing Uncertainties in Program Energy Savings Cost-Effectively**

*Dr. Hossein Haeri, Quantec, LLC, Portland, OR  
Derek Henriques and Iris Sulyma, BC Hydro, Vancouver, B.C.*

## **ABSTRACT**

This paper is a synopsis of a study sponsored by BC Hydro to map and analyze the business process for the implementation and evaluation of its Power Smart Partner program, which offer a suite of energy efficiency services to large C&I customers. It describes a process for identifying the risks and uncertainties facing energy efficiency projects, assessing their relative importance, and instituting appropriate mechanisms to mitigate their likely impacts on program performance in the context of conventional portfolio management techniques. The Analytic Hierarchy Process (AHP), a method for analyzing decision situations involving multiple criteria (attributes) and multiple decision makers was used to characterize various risk factors and to develop estimates of the range of probable impacts they might have on the program's performance. The results of the study showed that the program's existing risk management procedures help improve reliability of savings by approximately 65%. Measure performance and persistence of energy savings were found to be the most important risk factors and, therefore, should be the primary focus in risk management. On-going M&V were identified as the most effective strategies for managing uncertainties in energy savings. Inspections and credit checks did not appear to be particularly effective. Credit checks also have the greatest adverse effect on customer relations, followed by financial and technical reviews. The study further found that the adverse effects of many of the identified risk factors are likely to be offset by the expected increase in future avoided costs, which enhancing the value of the saved energy by as much as 30%.

# Optimizing DSM Program Portfolios

*William B. Kallock, Summit Blue Consulting, Hinesburg, VT  
Daniel Violette, Summit Blue Consulting, Boulder, CO*

## Abstract

One of the most fundamental questions in DSM program design and evaluation is whether the mix of programs in the DSM portfolio is the best or optimal set of programs for that jurisdiction. Could another mix of programs produce the same amount of savings with reduced uncertainty? Or, would it be possible to generate substantially more savings with little increase in the amount of uncertainty in the savings?

This paper addresses the issue of optimizing DSM program portfolios by applying theories from the financial community, namely the modern portfolio theory (MPT), used to create efficient stock portfolios. Like stock portfolios, energy efficiency program portfolios should be trying to provide as much return for the investment with as little risk as possible within the regulatory constraints. For energy efficiency programs, the return they are providing is actual energy savings and the risk is the uncertainty that these savings will be achieved.

Using the MPT, investors are able to create an "efficient portfolio," a portfolio that has the smallest attainable portfolio risk for a given level of expected return (or the largest expected return for a given level of risk). For every set of stocks or DSM programs, a curve known as the Efficient Frontier, can be calculated to show the relationship between risk and return for an optimized portfolio. If the portfolio lies below the curve then the portfolio is not efficient; the same return could be achieved with lower risk. The goal is to design a stock portfolio or an energy efficiency program portfolio that optimizes the return (or overall savings) and minimizes the risk (uncertainty that the savings will be achieved).

The paper applies the MPT to two of the most successful DSM program portfolios in the U.S. to determine if these portfolios could be improved. The analysis uses historical program data to develop the expected savings for each program, the uncertainty of the expected savings and the correlation of the program savings with the other programs in the portfolio. The results of the analysis are plotted against the Efficient Frontier to determine if the current portfolios of programs are the best or optimal set of programs. The analysis indicates that increased savings can be achieved without increasing the uncertainty of the savings.

The authors show that MPT can be used to evaluate the optimal mix of programs and is a valuable tool in DSM portfolio design. In designing programs, DSM program developers and regulators often have to balance many constraints including market transformation goals, low-income spending, etc. Using the MPT, some of these program constraints may actually help to balance the overall portfolio of programs, demonstrating added value, not constraint, to the portfolio.

## SESSION 8C

### LIGHTING MARKET EFFECTS

*Moderator: Timothy Melloch, ComEd*

#### PAPERS:

##### **Explaining Consumer Choice in Purchasing, Installing and Storing Compact Fluorescent Lamps**

Carrie Webber, KEMA, Inc.

Kathleen Gaffney, KEMA, Inc.

Daisy Allen, KEMA, Inc.

##### **Blinded by the Light: Why Are We in the Dark about How Many CFLs are Out There?**

Susan Oman, Nexus Market Research

Lynn Hoefgen, Nexus Market Research

Angela Li, National Grid

Ralph Prah, Ralph Prah & Associates

##### **Compact Fluorescent (CFL) Saturation in the Northeast: Where the Rubber Hits the Road**

Thomas Ledyard, RLW Analytics, Inc.

Susan Oman, Nexus Market Research

Angela Li, National Grid USA

Jeff Zynda, RLW Analytics, Inc.

#### SESSION SUMMARY:

This session will focus on residential Compact Fluorescent Lamp (CFL) programs, drawing on experiences in the Northeast and California. Three papers discuss a variety of issue related to program success, including market saturation, sales data, and understanding consumer barriers to the adoption of CFL technology.

The first paper, “Explaining Consumer Choice in Purchasing, Installing and Storing Compact Fluorescent Lamps,” takes a hard look at the non-price characteristics of CFLs and how they influence the customers’ decision to buy or not purchase this cost-saving technology. The authors abstracted data from a residential incentive program evaluation to identify and categorize the various barriers to adoption. These barriers include awareness and information, markets, experiential and inventory. CFLs face significant barriers, particularly in specialty applications such as chandeliers and dimmable fixtures.

The second paper, “Blinded by the Light: Why Are We in the Dark about How Many CFLs are Out There?,” discusses the current state of CFL sales tracking, and how the existing methods for estimating national sales are no longer accurate. As more states embrace energy efficiency as a means of addressing global warming, these inaccuracies become more apparent, and the authors provide a basis for advocating for a national sales tracking mechanism.

The third paper, “Compact Fluorescent (CFL) Saturation in the Northeast: Where the Rubber Hits the Road,” presents the case for using saturation rates – the ratio of CFLs to lamp sockets – as a key measure of program performance. The authors dissect several studies from New England states to evaluate market adoption of CFLs, and shows how saturation data can be used to inform the program manager regarding possible needed changes going forward.

# **Explaining Consumer Choice in Purchasing, Installing and Storing Compact Fluorescent Lamps**

*Carrie Webber, KEMA, Inc, Oakland, CA*  
*Kathleen Gaffney, KEMA, Inc., Oakland, CA*  
*Daisy Allen, KEMA, Inc., Oakland, CA*

## **Abstract**

The savings potential for compact fluorescent lamps (CFLs) is huge. The puzzling question is, if CFLs are so cost effective, and with utility programs devoting so much money to information and rebate campaigns, why are people not using more of them? Barriers to CFL adoption take a number of forms: technical (e.g. a CFL will not fit or function in a fixture), awareness and informational barriers (consumers don't know about them or do not understand the benefits), market barriers (price and availability), and experiential barriers (consumers have been disappointed with CFL performance or lifetime in the past).

One-hundred on-site surveys were conducted in California in households that purchased at least one CFL in 2004-2005. Each survey included a fixture inventory of both interior and exterior fixtures, and specific questions about the choice between CFLs and non-CFLs in specific fixtures in a subset of rooms (chosen on a rotating basis). Finally, CFLs in storage were inventoried, and the participant was asked why CFLs were stored rather than installed.

A large share of California's residential energy-efficiency portfolio is devoted to promoting CFLs. But right now, the CFLs subsidized by these programs fall into the black box that is consumer behavior. This study sheds light on consumers' decision processes with regard to where and when to install CFLs they have purchased. Without this understanding, program design and estimating program impacts are just a shot in the dark.

# **Blinded by the Light: Why Are We in the Dark about How Many CFLs are Out There?**

*Susan Oman, Nexus Market Research, Inc., Cambridge, MA*  
*Lynn Hoefgen, Nexus Market Research, Inc., Cambridge, MA*  
*Angela Li, National Grid, Westborough, MA*  
*Ralph Prah, Ralph Prah & Associates, Madison, WI*

## **Abstract**

How can lighting programs accurately measure program effects when our estimates of national compact fluorescent light (CFL) bulb sales are outdated? In this paper, we present evidence that commonly used estimates for national sales of CFLs are no longer accurate, explore how the national CFL market is changing, and examine why a nationally coordinated data collection effort is prudent. This paper stems from work we have done for one of the largest residential lighting programs in the nation, in which we estimate baseline CFL sales by creating a non-program comparison area using national CFL sales data minus sales from states with active programs.

# **Compact Fluorescent (CFL) Saturation in the Northeast: Where the Rubber Hits the Road**

*Thomas Ledyard, RLW Analytics, Inc. Middletown, CT*

*Susan Oman, Nexus Market Research, Concord, MA*

*Angela Li, National Grid USA, Northboro, MA*

*Jeff Zynda, RLW Analytics, Inc. Middletown, CT*

## **Abstract**

While there are many metrics of importance to an evaluator assessing a residential lighting program, one could argue that measuring changes in saturation --the ratio of compact fluorescent lamps (CFLs) to sockets -- provides one of the more important indicators of program success. Saturation reflects a broad range of program outcomes including net impacts, sales penetration, product persistence and installation, and usage in the region of interest. In a series of studies involving socket counts in homes throughout New England, we have gathered data that contribute to the body of evidence of regional program achievement via this primary indicator of success.

This paper provides a longitudinal view of CFL market saturation rates that is interesting to consider in the context of barriers that have been encountered during the emergence of CFL technology, the activities that have been undertaken to support its adoption and the unique nature of the challenge to unseat traditional Edison socket incandescent lighting from its ubiquitous place in the American household.

This paper provides some historical context of these issues in the Northeast along with information on how advocates of CFL adoption have structured their support of CFLs in the market place. We also present results of primary data collection efforts to illustrate how the adoption of the CFL technology has grown at the homeowner level over time. This adoption and saturation data is then utilized in multiple ways to show its usefulness in considering remaining potential as well as possible implications in program planning.

## SESSION 8D

### ESL–EVALUATION AS A SECOND LANGUAGE (OR HOW TO TRANSLATE THE VALUE OF EVALUATION RESULTS TO A DIVERSE AUDIENCE)

*Moderator: Kathleen Gaffney, KEMA*

#### PANELISTS:

Mike Sherman, Massachusetts Division of Energy Resources  
Charley Budd, KEMA (formerly Exelon)  
Monica Nevus, Consortium for Energy Efficiency (CEE)  
Carol Mullholland, PA Consulting

#### SESSION SUMMARY:

The idea for this panel formed while attending a panel at the 2006 ACEEE Summer Study. The panel was discussing the need for energy efficiency program evaluation results that were less focused on “widget counting” and more focused on understanding why consumers act the way they do. Panelists agreed that program designers and policy makers need evaluation results that help them predict and influence these actions.

As the panel discussion continued, it occurred to some of us in the audience that what we really have here is a “foreign language problem” – that is, over-specialized evaluators may not be aware they speak a different language than the majority of the users of their evaluation results. For example, program designers want research that helps them understand key customer segments and preferences. Of course, some of our evaluations provide this but more often this type of insight gets buried in text and tables drawing on complex analysis that program designers may not be able to comprehend (or willing to read).

Another example of our foreign language problem relates to need for evaluation results that give regulators specific answers to a specific policy question. How can a Commissioner get value from a 500-page, comprehensive report addressing a wide range of important issues? How can we “sum it all up” in five bullets or less, in language that a non-technical audience can understand and that signals action for community leaders and policy makers? (Think elevator pitch.)

Yet another example involves the media. First question: does the media at large even know our evaluation community exists? With so much coverage of energy and environmental issues in the mainstream media today, how can we ensure that journalists have access to evaluation results that are credible, independent, reliable, and responsible?

A final thought – are we even hitting the target? Are our evaluations even addressing the key issues of interest to a specific state or region? For example, if demand response is the most effective solution to a local or regional problem, are there evaluation results available or studies underway? If smart metering or real-time pricing are key components to the next generation of demand response programs, are there evaluation results or research being conducted to assess the potential for different technology and rate options? The same statements could be made for renewable programs, distributed generation technologies, climate change initiatives, and sustainable development plans.

This panel, “Evaluation as a Second Language,” reflects the potentially wide array of needs our evaluations can address and the importance of working closely with those outside our community to help translate the value of our work in helping bring informed energy policy decisions. The structure of the panel will involve a brief role playing exercise to illustrate some of the “foreign language problems” described above, followed a more indepth discussion from each of the panelists:

- Moderator **Kathleen Gaffney** will introduce the purpose of the panel, highlighting some of the key challenges evaluators may face in communicating results within today’s broader and more diverse energy policy and market context. Her discussion will set the stage for the “role playing exercise,” where our panel of industry experts will act out a scene that illustrates the challenges we face as evaluators when we try to make others outside our industry aware of our results, including the methodological and other important caveats that are often riddled with “evaluation speak.” Kathleen is a Director in KEMA’s Sustainable Market Strategies business practice.
- **Mike Sherman** will present a case study where, in Massachusetts, annual evaluation reports submitted to the Legislature, which were previously never read, are now having a real impact on the political discussion around increasing energy efficiency. The presentation of the cost of saved energy against the cost of generation in a tight generation market has proved very powerful. Mike is the Energy Efficiency Group Manager with the Massachusetts Division of Energy Resources.
- **Charley Budd** will focus his presentation from the perspective of senior utility management. He will discuss key areas where evaluation results can aid decision-makers in assessing risk and informing program design. Charley will draw on his 27 years of experience as a senior utility demand-side management program strategist with Consumers Energy in Michigan and Exelon in Illinois. Charley recently joined KEMA, as a Senior Principal in its Sustainable Market Strategies business practice.
- **Monica Nevius** will draw on illustrations from recent research conducted by the Consortium for Energy Efficiency (CEE) and discuss the importance of clear, consistent evaluation terms and definitions to communicating evaluation results and incorporating program impacts into resource planning. Monica is Manager of Research and Evaluation for the CEE, which is a nonprofit organization of administrators of publicly funded energy efficiency programs in North America.
- **Carol Mulholland** will summarize results from an ongoing AESP Evaluation Committee research project, “*Best Practices in Communicating Evaluation and Market Research Results Effectively To Decision-Makers and Media.*” Carol will present best practices in communicating complex energy-related messages and evaluation results to busy decision-makers and the media based on her recent interviews with communications experts in various organizations (e.g., government/regulatory affairs, utility management, public relations, media departments). Carol is a Principal Consultant with PA Consulting.



## SESSION 9A

### MEASURE LIFETIMES

*Moderator: Don Flynn, Northeast Utilities*

#### PAPERS:

##### **Updated Measure Lifetime Estimates: EULs Based on 10 Years of Studies**

Lisa Skumatz, Skumatz Economic Research Associates, Inc.

Scott Dimetrosky, Quantec, LLC

##### **Energy Savings Lifetimes of Measures: Will the New European Harmonized Lifetimes Account for Less Energy Savings Compared to the Policy Induced Energy Savings Measures?**

Harry H.J. Vreuls, SenterNovem

Piet G.M. Boonekamp, ECN

Harold J.M.B. Pauwels, NEN

#### SESSION SUMMARY:

This session focuses on measure lifetimes, an inherently important determinant in lifetime energy savings and cost effectiveness of energy efficiency measures. Two papers will be presented in this session. The first paper is based on studies performed in the United States, while the second paper discusses alternative measure lifetime strategies in the European arena. The presentations, each discussing contrasting perspectives from experiences in different markets, promises to set the stage for interesting dialogue among authors and session attendees.

Lisa Skumatz and Scott Dimetrosky will begin the session with a presentation of their paper entitled, *“Updated Measure Lifetime Estimates: EULs Based on 10 Years of Studies”* which lays out findings from a project conducted for the California Public Utilities Commission. The project identified real-world lifetimes for numerous residential and non-residential measures from an exhaustive review of data from more than 100 retention/lifetime studies. The authors will share consolidated recommended estimated useful lifetimes based on a statistical analysis of data from those studies.

Next, Harry Vreuls, joined by his colleagues Piet Boonekamp and Harold J.M.B. Pauwels will present a European perspective on lifetimes in their paper, *“Energy Savings Lifetimes of Measures: Will the New European Harmonized Lifetimes Account for Less Energy Savings Compared to the Policy Induced Energy Savings Measures?”* Energy efficiency metrics for the 27 European Union (EU) member states, including measure lifetimes, are undergoing change. Vreuls and his colleagues will discuss the impacts these changes have on lifetimes and energy savings. Options available to EU members, including harmonized and country-specific lifetime figures, will be discussed and contrasted.

The Measure Lifetimes session will conclude with ample time for an interactive discussion and question and answer period among the authors and session attendees.

# Updated Measure Lifetime Estimates: EULs Based on 10 Years of Studies

*Lisa A. Skumatz, Ph.D.<sup>1</sup> Skumatz Economic Research Associates, Inc. (SERA)  
Scott Dimetrosky, Quantec LLC*

## Abstract

As part of a project for the California Public Utilities Commission (CPUC), the authors conducted a detailed assessment of more than 100 measure retention / lifetime studies to identify the real-world lifetimes for numerous measures used in an array of residential and non-residential buildings.

Estimated useful lifetimes (EULs, or measure lifetimes), in conjunction with energy savings estimates, are the key elements in computing energy savings for a program or intervention. These savings estimates are used to plan programs, and are also critical inputs used to determine the shareholder earnings for the utilities in relation to investment in programs.

Many of the EULs had not been updated for more than a decade, and this project used results from 10 years of studies to identify updated EULs that could be supported by real-world program experience, as well as identifying those EULs in need of additional studies to support their values. For each study, the authors conducted an exhaustive review of program measures, sampling methodologies and approach; field work; data validation; and analysis steps to determine whether reliable lifetime information could be gleaned. The authors conducted a detailed evaluation of the statistical techniques used in each study, and in some cases, re-estimated EULs using more reliable techniques.

The paper provides information on updated / recommended EUL estimates for a wide array of residential, and non-residential energy efficiency equipment. The implications related to gaps in available EUL information – especially as it relates to key equipment – and reliable estimates of EUL values for planning for future programs are presented. These results are currently being used in for State and utility program planning.

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<sup>1</sup> Quantec LLC served as a subcontractor to SERA for portions of this work.

# **Energy Savings Lifetimes of Measures: Will the New European Harmonized Lifetimes Account for Less Energy Savings Compared to the Policy Induced Energy Savings Measures?**

*Harry H.J. Vreuls, SenterNovem, The Netherlands  
Piet, G.M. Boonekamp, ECN, The Netherlands and  
Harold J.M.B. Pauwels, NEN, The Netherlands*

## **Abstract**

In early 2006, the new Directive on energy end-use efficiency and energy services (ESD) came into force for all 27 member states of the European Union. To facilitate reporting by member states, the European Commission is developing a harmonized system of bottom-up energy savings calculations. These calculations ask for, among other inputs, the lifetime of implemented measures. The European Committee for Standardization (CEN) assisted in updating the provisional list by organizing a CEN Workshop Agreement on lifetimes of energy efficiency improvement measures in bottom-up calculations.<sup>1</sup>

This paper deals with discussions on the definition of the lifetime. Which definition is most appropriate: the saving period: the design lifetime, the economic (pay back) lifetime or the social lifetime? And, how is this selection related to energy saving calculations? How does the market penetration of ever more efficient saving options influence actual savings and lifetime? Should yearly savings be processed into one (relative short time) simple number, or a longer one with savings that slow down over time? The paper also presents the options available to countries: an EU harmonized lifetime figure, a country-specific calculated lifetime figure or even a more sophisticated one. For several technical measures the applicable method to determine the lifetime is given as well as the differences between the harmonized lifetime and the conservative default value. The paper concludes that the savings lifetimes are in most case longer than the economic pay back period. As the default values give less credit to the accountable savings for the policy measures, this approach encourages countries to determine a country specific lifetime.

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<sup>1</sup> CEN-CWA 15693 *Saving lifetimes of Energy Efficiency Improvement Measures in bottom-up calculations*, CEN, 2007, [www.cen.eu](http://www.cen.eu)

## SESSION 9B

### CFL PROMOTION AND EVALUATION

*Moderator: Jim Mapp, Wisconsin Division of Energy*

#### PAPERS:

##### **Monitoring and Evaluation of a Regional Compact Fluorescent Lamp Pilot Program in New Zealand**

Peter Watt, Energy Mad Ltd (formerly of the Electricity Commission)

##### **Energizing Communities: Leveraging Non-Profit Organizations to Promote CFLS**

Katherine Johnson, Market Development Group

Ed Thomas, Market Development Group

##### **How Much Is That CFL in the Window? I Do Hope It Is On Sale: Examining Price Differentials between CFL and Incandescent Light Bulbs**

Greg Clendenning, Nexus Market Research

Timothy Pettit, Nexus Market Research, Inc.

Lynn Hoefgen, Nexus Market Research, Inc.

Angela Li, National Grid

#### SESSION SUMMARY:

This session will present evaluation results from three different program approaches. One uses a traditional voucher program marketing approach. The second uses an innovative program utilizing local non profit organizations for marketing without subsidies and third is a baseline study of incremental price differentials between CFLs and incandescent light bulbs for use in setting incentive levels for CFL promotional programs.

The first paper present results from a regional Compact Fluorescent Lamp pilot project in New Zealand. The Christchurch region pilot program was the first project undertaken by the newly established Electricity Commission of New Zealand to convert electricity policy into practical programs. The evaluation studied consumer awareness, key components of purchasing decisions, installation rates and measures of consumer satisfaction and the effectiveness of using vouchers as a promotional tool. The paper will also report on electricity saving, demand reduction and emissions eliminated due to the pilot project. The paper will also point toward new directions for energy efficiency in New Zealand.

The second paper reports on the results of an innovative program to promote CFLs sponsored by the Delta-Montrose Rural Electric Cooperative of Montrose, CO. The program partnered with leading CFL manufacturer, targeted high use sockets, and utilized non-profit organizations funding efforts to purchase energy efficient lighting products from local community groups. Educational efforts encouraged consumers to purchase a full range of products from local retailers. The paper will report on the usefulness of the non profit fund raiser model approach as an effective method for the promotion of energy efficient lighting. The evaluation will report on additional or improved program elements to improve the penetration energy efficient lighting products.

The third paper reports on a study of lighting product retailers in Massachusetts. The primary goal was to determine the incremental cost of various types of CFLs compared to comparable incandescent light bulbs. The paper will report on the incremental cost of various specialty CFL bulbs. This baseline study can be used to track market transformation toward energy efficient lighting in the

Massachusetts residential lighting market. The results can also be used to assist program managers in setting incentive levels for the promotion of CFLs.

The session will compare and contrast the three program delivery mechanisms of vouchers, use of non profit fund raisers and incentive programs to suggest improvements for future programs.

# **Evaluation of a Regional Compact Fluorescent Lamp Electricity Efficiency Pilot Program in New Zealand**

*Peter Watt, Energy Mad Ltd (formerly of the Electricity Commission), Wellington, New Zealand*

## **Abstract**

The Electricity Commission of New Zealand (Commission), the electricity industry regulator, implemented a pilot residential compact fluorescent lamp (CFL) program to evaluate CFL effectiveness in improving electricity efficiency prior to a national rollout. The Commission's electricity efficiency activities are funded by a levy on electric energy sold. The Commission implemented the pilot in partnership with the local network company and the predominate generator/retailer in the area. CFL distribution was through a national grocery supermarket chain. Commission and partner funding, including a zero retail margin contributed by the supermarket, significantly reduced the cost of the product to consumers. Evaluation elements of the pilot program were designed to assess the outcomes of the pilot and to inform the final program design prior to a national rollout. The main objectives of the evaluation work were to assess actual electricity savings, peak demand reductions, marketing and delivery channels, consumer acceptance of the technology and changes in consumer behaviour.

The evaluation work included two telephone surveys and in-home data logging of CFL usage.

# **Energizing Communities: Leveraging Non-Profit Organizations to Promote CFLs**

*Katherine Johnson, Market Development Group, Frederick, MD  
Ed Thomas, Market Development Group, Montrose, CO*

## **Abstract**

Compact fluorescent lamps (CFLs) have been a mainstay within the energy efficiency community for more than a decade. However, many smaller cities and locations, especially those in rural areas, have not been the subject of targeted outreach campaigns that promote the purchase and/or installation of this energy efficient technology.

In the past, most utilities have relied on more traditional approaches to promote CFLs to communities, usually through light bulb giveaways. But this approach dilutes the value of both the product and the message since customers have nothing invested in energy efficiency improvements.

Delta-Montrose Electric Association (DMEA) a 30,000-member Rural Electric Cooperative in Montrose, CO tried a more unique outreach strategy. In 2005, the utility developed and implemented a Light Bulb Fund Raiser program to encourage members to replace their most-used incandescent light bulbs with compact fluorescent lamps.

This paper compares the process and impact results from 2005 and 2006 and identifies the successful way in which program evaluation was built into the “DNA” of this program design. It also illustrates how energy organizations can promote energy efficiency improvements, such as CFLs, *without subsidies*, compared to the more traditional rebate and giveaway programs. This program demonstrates that customers value energy efficiency, especially when the savings can be tied directly to environmental and community benefits. The paper will also include examples of the program advertising and marketing materials, such as sales training, promotional materials, and evaluation strategies that have made this an award-winning and successful residential outreach campaign.

# **How Much Is That CFL in the Window? I Do Hope It Is on Sale: Examining Price Differentials between CFL and Incandescent Light Bulbs**

*Greg Clendenning, Nexus Market Research, Inc., Arlington, VA*

*Timothy Pettit, Nexus Market Research, Inc., Arlington, VA*

*Lynn Hoefgen, Nexus Market Research, Inc., Cambridge, MA*

*Angela Li, National Grid, Northborough, MA*

## **Abstract**

Market transformation programs often include incentives that serve to catalyze the adoption of energy efficient products. As market transformation takes place, one general indicator is that the price differential between the standard product and the energy-efficient product should decline due to the temporary market support of the incentives, technological advances, mass production, competition and other market forces. As price differentials decline, incentive levels can be reduced, and ultimately eliminated.

In the case of the residential lighting market, a key indicator of the state of market transformation is the price differential between a CFL and a comparable incandescent bulb. This study uses data from a survey of lighting product retailers conducted in Massachusetts at the beginning of 2006 to assess the differences in prices between CFL and comparable incandescent bulbs. Data were analyzed on two types of incandescent bulbs—standard and 3-way bulbs—and on five types of CFLs—standard CFLs and four specialty CFLs.

Results from this analysis provide several price indicators of the market transformation of the Massachusetts residential lighting market. In addition, this analysis can help program managers determine appropriate incentive levels for CFL light bulbs. While program managers often depend upon anecdotal or gut level estimates of appropriate incentive levels, this analysis can provide a more rational basis for setting incentive levels.



## SESSION 9C

### E PLURIBUS ALMOST UNUM – DEVELOPING COMMON EVALUATION POLICIES AND PROTOCOLS ACROSS SIX STATES

*Moderator: Carol White, National Grid*

#### PANELISTS:

Michael Sherman, Massachusetts Division of Energy Resources  
Chris Neme, Vermont Energy Investment Corporation  
Elizabeth Titus, Northeast Energy Efficiency Partnerships

#### SESSION SUMMARY:

The Independent System Operator-New England (ISO-NE) has developed market rules and defined monitoring and verification procedures that are designed to foster the development of a forward capacity market that recognizes and values traditional supply, energy efficiency, load management, distributed resources, and demand response as legitimate resources that can be used to ensure a reliable integrated electric system in New England. In response to those developments, the New England Conference of Public Utility Commissioners committed “to the development of common protocols to measure, verify, and report energy efficiency savings derived from the publicly-funded energy efficiency programs operated (administered) by the various implementation organizations operating within New England whose expenditures and accomplishments are subject to state utility commission (regulatory agency) review.” That resolution led to the creation of the “State Programs Working Group,” SPWG. The SPWG includes representatives from each of the state regulatory agencies in New England and program administrators with efforts facilitated by the Northeast Energy Efficiency Partnerships (NEEP).

A Steering Committee that includes Julie Michals and Elizabeth Titus from NEEP, Jeff Schlegel representing the states of CT and MA, Chris Neme from the Vermont Energy Investment Corporation (which runs Efficiency Vermont), Carol White from National Grid, and Tom Belair from Public Service Company of New Hampshire has been charged with advising and supporting SPWG efforts.

This New England effort to develop consistent policies and common evaluation/M&V protocols is also important in the context of the reductions in carbon emissions in the region due to energy efficiency activities, particularly as part of the Regional Greenhouse Gas Initiative (RGGI).

This panel will address the challenges involved in developing consistent evaluation policies and defining common evaluation protocols in a region where unique requirements have historically been defined by each state. The panel will also address how these state efforts have been integrated with developments at ISO-NE, including the M&V rules for the forward capacity market. Panelists will be able to discuss the process and outcomes of the SPWG’s efforts as well as developments at ISO-NE while specifically addressing:

- The unique challenges involved when participating on a regional effort as a regulator.
- How the states work together and how the process might be improved.
- Protocols expected to be addressed with a focus on both short-term and long-term issues.
- What the process has been like for a resource provider.
- Costs, implications for evaluation planning, and state issues.

- Issues unique to northern versus southern New England state.
- Issues faced by small versus large program administrators.
- Issues faced by different types of program administrators (e.g. utility and non-utility administrators)

## **SESSION 9D**

### **EVALUATORS' BIAS – ARE FIREWALLS THE ANSWER?**

*Moderator: Douglas Mahone, Heschong Mahone Group Inc.*

#### **PANELISTS:**

Ben Bronfman, Quantec LLC  
Larry Pakenas, New York State Energy Research and Development Authority  
Nick Hall, TecMarket Works

#### **SESSION SUMMARY:**

Bias has been a concern of program evaluators from the start; the credibility both of the evaluation results and of the evaluators themselves are at stake. Evaluation standards and protocols have been developed in an attempt to control for a wide variety of evaluator biases. Despite these efforts, however, bias continues to be a concern. For example, the California PUC has determined that certain types of evaluator conflicts of interest will inevitably bias, or appear to bias, evaluation findings. The result is the evaluation "firewall" in California, which forbids any evaluator from conducting any impact evaluation, if that evaluator is involved with any type of program implementation. Other jurisdictions reject the simple firewall approach, and instead treat bias as an issue to be addressed case-by-case.

Panel members will review the key aspects of the evaluation bias issue and discuss the advantages and disadvantages of different approaches to addressing bias. In doing this, the following questions will be addressed:

- Real world examples of evaluation bias or conflict-of-interest problems
- What are the American Evaluation Association Guiding Principles for addressing bias?
- How does the California PUC firewall address bias? How do other programs, including NYSERDA and the Northwest address evaluation bias?
- Do the needs of stakeholders and uses of evaluation results affect the treatment of bias? E.g., California evaluation results determine utility shareholder earnings and procurement needs; NYSERDA evaluation results inform program implementers and public policymakers.

The panel includes evaluation practitioners, evaluation managers, and users of evaluation results. They will be speaking from direct personal experience, and will also contribute policy insight to the discussion. Audience members will be invited to contribute real world examples and perspectives from other energy efficiency organizations/evaluators.

## 2007 Poster Session

*Moderator: Elizabeth Titus, Northeast Energy Efficiency Partnerships, Inc.*

### List of Posters

- **Quantifying a Moving Target: Challenges in Measuring Market Share for Market Transformation Programs**, by *Kathleen Hunt and Laura Safrance, Enbridge Gas Distribution, Toronto, Ontario, Canada*
- **Conditional Demand Analysis of Residential Energy Consumption**, by *K. H. Tiedemann, BC Hydro, Vancouver, BC*
- **Back to the Future: Re-integrating demand-side resource planning with open-access software**, by *Paul Meier, Energy Institute, UW-Madison*
- **Taking a Bath on Showerhead Savings**, by *Kathryn E. Parlin, Al Bartsch, West Hill Energy & Computing, Chelsea, VT and Robert Wirtschafter, Wirtschafter Associates, Rydal, PA*
- **It's What You Do With You've Got, That Pays Off in the End: Energy and Demand Savings Estimates with Parsimonious Data**, by *Jim Mapp and Barbara Smith, Division of Energy Services, Madison, WI*
- **Measuring The Impact Of Programmable Thermostats In Gas Heated Homes**, by *Tim Hennessy, RLW Analytics, Inc., Clark Lake, MI*
- **If You Build It, They Will Come: Lessons Learned in Creating an Interactive Lighting Display**, by *Jennifer E. Canseco and Kathleen Gaffney, KEMA Inc.*
- **Duct Soup: Research and Impact Results for Duct Sealing Programs**, by *Elizabeth Titus, Northeast Energy Efficiency Alliance, Timothy Pettit, Nexus Market Research, Robert Wirtschafter, Wirtschafter and Associates*
- **A Framework for Energy Education and Training Program Portfolio Valuation**, by *Kathleen Gaffney, KEMA, Inc., Oakland, California*
- **Failure to Follow-Through: Trends in Completion Rates of Residential Renewable Energy and Energy Efficiency Projects**, by *Eileen Hannigan, Wisconsin Energy Conservation Corporation, Madison, WI*
- **Energy Efficiency and Energy Education for Low-Income Households**, by *Jamie Drakos, M. Sami Kawaja, and Anne West, Quantec, LLC, Portland, OR*
- **Predicting Naturally Occurring Energy Efficiency – Development and Application of a New Tool to Obtain Expert Input**, by *Allen Lee and M. Sami Kawaja, Quantec LLC, Portland OR and Nicholas Hall, TecMarket Works, Oregon, WI*
- **NEBS from the Societal Perspective: Methods, Results, Patterns and Implications**, by *Lisa Skumatz, Skumatz Economic Research Associates, Inc. Superior, CO*
- **Mapping Software as a Program Management and Evaluation Tool**, by *Heidi Ochsner et al, Itron, La Jolla, CA, Shel Feldman, Shel Feldman Management Consulting, Madison, WI and Judy Mathewson, We Energies, Madison, WI*
- **Solar Incentive Structures and the Impacts of PV Performance and Costs**, by *George Simons et al, Itron Inc., La Jolla, CA and Pierre Landry, Southern California Edison, Los Angeles, CA*
- **CO<sub>2</sub> Trading Program Assessment: Recommendations for Kosovo**, by *Dafina Gashi, Rochester Institute of Technology, Rochester, NY*
- **Willingness to Pay for a Clear Night Sky: Use of the Contingent Valuation Method**, by *Stephanie Simpson, Rochester Institute of Technology, Rochester, NY*

## Summaries:

**Quantifying a Moving Target: Challenges in Measuring Market Share for Market Transformation Programs** presents Enbridge Gas Distribution's experience in measuring the success of the company's first Demand Side Management (DSM) market transformation program, to increase the market share of ENERGY STAR® windows. Post program research included surveying industry manufacturers. The poster reviews the multi-faceted marketing activities and market research completed since 2006 as well as the research challenges encountered.

**Conditional Demand Analysis of Residential Energy Consumption** summarizes the methodology and results of two residential end-use studies for electricity and natural gas for British Columbia to estimate Unit Energy Consumption (UEC) values for 14 electricity 0 natural gas residential end-uses, with results weighted to the customer population. Primary electric space heating at 5,037 kWh per year, electric water heating at 3,186 per year, and primary gas space heating at 67.80 GJ per year, and water heating at 20.76 GJ per year were among the results.

**Back to the Future: Re-integrating Demand-side Resource Planning with Open-access Software** presents a cost-benefit analysis of energy efficient technologies based on a simple integrated resource model. Avoided electrical generation is estimated in four time periods peak and off-peak seasons, and peak and off-peak hours and the benefits are estimated by evaluating an efficient scenario against a baseline scenario. Results from the end-user, IOU, and societal perspective are reviewed, as well as the technical challenges and limitations of the assessment, including data availability and characterization of wholesale electricity markets.

In **Taking a Bath on Showerhead Savings**, showerhead savings were derived as one component of an impact evaluation for a low income program, when it was virtually impossible to isolate these savings from other hot water measure savings in a regression mode, by combining bench testing with on site data collection. The results challenge current assumptions about showerhead replacements and provide valuable insights into possible modifications to field implementation.

**It's What You Do With You've Got, That Pays Off in the End Energy and Demand Savings Estimates with Parsimonious Data:** Annual electrical energy and demand savings from refrigerator turn ins were estimated using an incomplete sample and householder reported or field collected data.

The research shows that reliable energy usage estimates for turn-in and replacement programs can be made without monitoring data for the five major types of refrigerators and three types of freezers manufactured between 1940 and the present.

**Measuring The Impact Of Programmable Thermostats In Gas Heated Homes:** A survey-supported billing analysis on a large sample of participants in the GasNetworks ENERGY STAR® Qualified Thermostat Rebate Program used a test-control experimental design to help control for extraneous variables yielding net program impacts from the analysis. Savings of 80ccf, or 6.2% of total household annual natural gas consumption, at a relative precision of  $\pm 23.7\%$  were estimated. This yields a 90% confidence interval from 61ccf to 99ccf or a percent savings ranging from a low of 4.7% to a high of 7.7% of normalized annual total household consumption.

**If You Build It, They Will Come: Lessons Learned in Creating an Interactive Lighting Display:** Many challenges remain with wider-spread adoption of CFLs, as found when the authors set out to build an interactive lighting display to showcase current compact fluorescent lamp (CFL) technologies. Bulbs required for the display were difficult to obtain and, once obtained, posed implementation challenges.

**Duct Soup: Research and Impact Results for Duct Sealing Programs** shows that a recipe for good duct sealing programs considers: 1) facts and figures about how leaky and/or poorly designed duct systems affect potential energy savings; 2) the menu of programs throughout the nation, factors that impact the types of

programs that are provided, the level of participation by contractors and customers; and 3) necessary ingredients to delivering a successful duct sealing program based on recent regional research efforts.

**A Framework for Energy Education and Training Program Portfolio Valuation:** Evaluators' toolkits are still missing effective strategies for assessing the value of energy education and training programs. To fill that gap, a systematic way of characterizing and valuing the education and training courses "portfolio" akin to investors' financial portfolio frameworks is presented; it was developed based on results of a recent evaluation of California's Statewide Education, Training and Services (ETS) Program.

**In Failure to Follow Through: Trends in Completion Rates of Residential Renewable Energy and Energy Efficiency Projects,** insights into declining completion rates and barriers to participation in two residential programs in Wisconsin are provided, based on an analysis that combined program survey and U.S. Census data.

**Energy Efficiency and Energy Education for Low-Income Households** presents the potential qualitative and quantitative household and utility benefits of low-income programs based on a comparison of various programs in the U.S..

**Predicting Naturally Occurring Energy Efficiency- Development and Application of a New Tool to Obtain Expert Input:** An interactive web-based graphical display is at the heart of this innovative process to estimate energy savings net of naturally occurring market adoption of efficient building and appliances. It combines a Delphi approach and logit-based estimators of product adoption rates.

**NEBS from the Societal Perspective: Methods, Results, Patterns, and Implications** provides an overview discussion of many different non-energy benefits, such as job creation, reduced power plant emissions or wastewater, and how they can be credited by energy efficiency cost-benefit analysis if they can be quantified.

Examples of how **Mapping Software as a Program Management and Evaluation Tool** supports tracking and evaluation are provided from applications of Geographic Information System (GIS) software in two utility programs, one that installs CFLs in low income households and one installing efficient dairy farm equipment.

**Solar Incentive Structures and the Impacts of PV Performance and Costs** reports baseline information on PV performance and costs in California and results of 39 prototype PV market scenarios to aid policymakers in designing market transformation program incentive structures.

**CO<sub>2</sub> Trading Program Assessment: Recommendations for Kosovo** presents the methodology and results from academic research to assess Kosovo's future potential for establishing a CO<sub>2</sub> trading program, including results of an international comparative analysis of CO<sub>2</sub> emission trading programs and auction system along with an assessment of Kosovo's current energy policies and political, economic, and environmental conditions, all of which can contribute to plans for Kosovo's future potential for establishing a CO<sub>2</sub> trading program.

**Willingness to Pay for a Clear Night Sky: Use of the Contingent Valuation Method** presents the results of academic research that demonstrates the use of the contingent valuation method to place an economic value on light pollution, based on results of students surveyed regarding their willingness to pay for a clear night sky, with the expectation that a measured value of clear, unobstructed night sky, can become an input into a cost-benefit analysis for use by policy makers in making informed decisions regarding light pollution.

# If You Build It, They Will Come: Lessons Learned in Creating an Interactive Lighting Display

*Jennifer E. Canseco, KEMA Inc.*

*Kathleen Gaffney, KEMA Inc.*

## Introduction

This poster presents the trials and tribulations encountered by the authors when they set out to build an interactive lighting display to showcase current compact fluorescent lamp (CFL) technologies. In creating this display, the authors had two main goals: obtain up to 10 lamp styles, and within each of these, obtain lamps of the same wattage from variety of manufacturers to demonstrate variations in color temperature, light output [lumens], and other characteristics by manufacturer. The authors assumed the task of acquiring lamps would be relatively simple, but soon learned that the bulbs required for the display would be difficult to obtain and, once obtained, pose challenges in implementing the display.

## Challenges

The authors encountered several unanticipated obstacles their search for CFLs:

1. Availability and product diversity: To acquire the 30 lamps ultimately used in the display, CFLs were purchased from five brick-and-mortar stores and five online outlets. The former generally offered a limited variety of lamp styles from one or two manufacturers, and the latter often provided inconsistent information from one manufacturer to the next (and also from one website to the next).
2. Inconsistent packaging claims: CFL packaging often provided inconsistent and potentially inaccurate information. For example, the authors purchased three different 23-Watt Energy Star® compact fluorescent flood lamps. The packaging information for each of these three bulbs was inconsistent, including different claims for energy cost savings, lifetime, and incandescent wattage equivalencies.
3. Lack of information on light output for incandescent lamps: The industry has shifted away from educating consumers about CFL-to-incandescent wattage equivalence and moved toward looking for equivalent light output (lumens). Most of the CFL packages mentioned lumens, but none of the incandescent lamp packages we examined made any similar statement to enable comparison.
4. Product performance: Of the bulbs acquired from websites, approximately 20 percent arrived broken. Once installed in the CFL lighting display, several bulbs failed, experienced delays in start-up, produced flickering light, and/or performed poorly when integrated with the wireless control system.

## Conclusions

The process confirmed findings from other research that suggest there are many lingering challenges associated with wider-spread adoption of CFLs – which has implications for energy-efficiency program design. Small twister-style CFLs are widely available and inexpensive, but finding other styles still poses a challenge. Program designers should consider providing energy-efficiency program incentives for a diverse array of high-quality CFLs – in a range of styles and wattages – as one strategy for overcoming the market barriers of CFL product availability, diversity, and performance. A focus on consumer education will also

continue to be important, particularly if no substantial improvements are made in the accuracy and consistency of product packaging.



**It's a Tankless Job, but Somebody's Gotta Do It:  
Assessing Consumer Reactions to a Utility-Sponsored Tankless Water Heating Program**

*Greg Clendenning, Nexus Market Research, Inc., Washington, DC  
Lynn Hoefgen, Nexus Market Research, Inc., Cambridge, MA  
Subid Wagley, Keyspan Energy, Waltham, MA*

## **Introduction**

Tankless natural gas water heaters, described as a “Classic Market Transformation Opportunity” at the 2006 National Symposium on Market Transformation, account for less than 2% of the 5,000,000 gas water heaters sold annually in the United States. Those who would promote tankless water heaters face formidable market barriers such as higher cost, lack of customer familiarity, and inappropriate installations leading to customer dissatisfaction.

## **Methods and Analysis**

Little is known about recent purchasers of tankless water heaters, and understanding recent purchasers of tankless water heaters is crucial to designing successful new market transformations and refining current market transformations. This study uses data collected in the Fall of 2006 from 101 households that participated in the Gas Network's tankless water heater rebate program. The following aspects of customer attitudes and behavior are assessed in this study:

- How do people find out about tankless water heaters?
- Why did they purchase a tankless water heaters
- How satisfied are program participants and what leads to their satisfaction or dissatisfaction?
- How do they use their tankless water heaters?
- What kinds of people are buying tankless water heaters?

Participants are extremely satisfied with their tankless water heaters. However, satisfaction may be associated with the distance between the water heater and the primary point of usage. Participants who installed their tankless water heater farther from the point of usage than the water heater it replaced are less satisfied with the overall performance of the water heater, with the amount of time it takes hot water to come out of the faucet, and with the reliability of the water heater. In addition, one-third of all respondents cite the time it takes hot water to come out of the faucet as the characteristic with which they are most dissatisfied

Program participants predominantly live in single family homes that are less than 4,000 square feet in size, are middle aged, have moderate to high annual household incomes, are well educated, and live in households with four or fewer people. The primary motivation for purchasing a tankless water heater for more than one-half of respondents is to save energy or gas. Ninety percent of respondents replaced a storage tank water heater with their tankless water heater, and 75% of respondents estimate that they now use about the same amount of hot water as when they had a storage tank water heater.

## **Policy Implications and Importance to Program Managers**

Participant satisfaction with their tankless water heaters should be encouraging to program managers, and rebate programs and other market transformation efforts can help address price and information barriers faced by tankless water heaters. However, program managers should recognize that professional training of plumbers and contractors on proper placement and installation of tankless water heaters may be a critical to customer satisfaction.

# **Energy Efficiency and Energy Education for Low-Income Households**

*Jamie Drakos, Quantec, LLC, Portland, OR*  
*M. Sami Khawaja, PhD, Quantec, LLC, Portland, OR*  
*Anne West, Quantec, LLC, Portland, OR*

## **Introduction**

This poster presents the implementation and results of several low-income energy efficiency/energy education programs in different parts of the country. The programs highlighted combine a highly interactive energy education curriculum with low-cost, energy efficiency measures that clients install in their own homes. The goal of these programs is to empower low-income families to reduce their energy usage and consequent energy burden.

## **Energy Education**

Interactive energy education appealing to all adult learning styles benefits both families and program sponsors. On a fundamental level, adults usually learn best by one of three methods: visual, auditory, and kinesthetic. An energy education curriculum designed to engage all learning methods will have the best chance of success. Interactive energy education programs that seek to appeal to different learning styles generate more client interest and engagement.

## **Energy Efficiency Measures**

A kit of do-it-yourself energy efficiency measures, supplied along with energy education programs, can provide great benefits to the program and participants as participants are able to take immediate action to reduce their home energy usage. The kit's measures introduce households to the Energy Star® label and encourage them to seek similar products in the future. Typically, the kit includes compact fluorescent lamps (CFLs), a high-efficiency showerhead, high-efficiency faucet aerators (both bathroom and kitchen), a furnace filter alarm, and tools for measuring temperatures of rooms and temperatures of water heaters, refrigerators, and freezers. Some kits also include: high-efficiency, hand-held showerheads; infiltration reduction tools, such as caulk, plastic window covering, light switch plate and outlet gaskets, and rope putty (backer rod); an LED night light; and a shower timer. The ease of installing the do-it-yourself energy efficiency measures can be the first step toward saving energy in a home. Energy educators also share a variety of other low-cost measures participants can purchase and install on their own to save more energy and money.

## **Impacts**

With the energy education and energy efficiency measures installed, an engaged household can potentially save over \$200 per year. This can contribute greatly to lowering a household's energy burden.

The benefits for a utility or state implementing an energy education program can be substantial, one program, serving 4,000 households generated savings of 1 million kWh and 140,000 therms.<sup>1</sup>

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<sup>1</sup> Quantec, LLC, [Iowa Energy Wise 2005-2006 Program Analysis](#), March 2007.

Additionally, low-income communities increase their awareness of energy usage and energy efficient behaviors, and simultaneously, these values are instilled in the next generation.

# **A Framework for Energy Education and Training Program Portfolio Valuation**

*Kathleen Gaffney, KEMA, Inc., Oakland, California*

## **Introduction**

Evaluators have taken many approaches to assessing the value of energy education and training programs. What appears to be lacking in the current toolkit, however, is a systematic way of characterizing the types of education and training courses being offered, as well as a process for determining the overall value of the energy education and training “portfolio” or program. In much the same way that investors characterize and value various attributes and features of different stocks and assets in their financial portfolio, this poster presents a framework for developing a similar type of valuation system.

The framework draws on research and analysis completed for a recent evaluation of California’s Statewide Education, Training and Services (ETS) Program. During 2004-2005, more than 1,000 different energy education and training courses were offered through this program, ranging in such diverse topics as basic energy efficiency concepts, energy code and standards updates, photovoltaic (PV) technologies, sustainable building design practices, and other end-use and sector-specific topics.

## **Approach**

The approach taken in this study was to characterize features and attributes of the energy education and training courses, as well as the actual attendees (over 30,000 people attended courses during 2004-2005). The characterization process was meant to provide descriptive information for each course (e.g., who attended, what was the course format, how often was the course offered, what did the course cover, etc.) based on a thorough review of course materials and attendance lists, indepth interviews with utility program managers and course designers, and a telephone survey with over 1,500 course attendees.

Next, a set of categories was developed to represent the full range of objectives the different Energy Center courses were designed to address. Examples of the categories developed include: addressing direct, measurable energy savings potential; reaching a broad (or targeted) set of participants; providing direct linkages to another utility program (e.g., a rebate program); and emphasizing strategic or innovative concepts in the energy efficiency and related fields.

Each course was then assigned a score for each of these categories, and the scores were aggregated across all courses offered during 2004-2005 to produce a “dashboard scorecard” for each of the Energy Centers. This dashboard scorecard provides program managers and planners with means to interpret the value of their overall energy education and training program portfolio. The dashboard scorecard also allows program designers to easily identify gaps in the program portfolio to guide them in developing new program offerings.

# NEBS from the Societal Perspective: Methods, Results, Patterns, and Implications

*Lisa A. Skumatz, Ph.D., Skumatz Economic Research Associates, Inc. (SERA), Superior, CO*

This poster demonstrates methods and results measuring key societal non-energy benefits (NEBs), including economic development / job creation, and environmental effects. Results from multiple US and international programs are analyzed, and patterns by program type, region, and valuation method are presented. The results provide data useful in optimizing program benefits.

The non-energy benefits associated with energy-efficiency programs are valuable aspects of program participation that arise as an indirect result of the use of energy efficiency measures implemented through such programs. That is, they are benefits that are not directly related to reduced energy use or the associated energy bill savings, but would not have occurred if the technology that produced those energy savings had not been implemented. Skumatz and Dickerson (1997) defines three primary categories of non-energy benefits, based on the recipient of the benefit:

- *Participant benefits* are non-energy effects that are enjoyed only by participants in energy efficiency programs. These benefits include increased aesthetics and comfort in the home, better lighting, better climate control and even a reduction in sickness. Commercial program examples might also include productivity changes, maintenance effects and others.
- *Utility benefits* are non-energy benefits that accrue to the utility or agency delivering the program as a result of the efficiency program. Utility benefits can include reduced transmission and distribution costs, fewer shutoffs and shutoff notices, fewer phone calls made to customers, fewer reactivations, etc. These ultimately represent benefits to ratepayers who see lower revenue requirements for the agency as a result of the program's NEBs.
- *Societal benefits* are non-energy benefits that can be enjoyed by anyone, regardless of program participation. These include changes in job creation / economic multiplier effects, emissions / environmental effects, public health and safety effects, water and waste water treatment or supply infrastructure, and other effects as a result of public programs.

Non-energy benefits valuations related to the societal perspective are becoming increasingly important to evaluators and administrators of programs, and also to communities with sustainability goals. This poster summarizes measurement methods and presents findings on:

- Variations in results by program type – weatherization, appliance rebate, education/outreach
- Differences in results based on geographic region covered by the program (territory)
- Differences in results based on assumptions about whether the program funds were assumed to transfer from industry sectors related to “electricity generation” vs. a market basket of goods, which may be an appropriate proxy for the public goods charge.

On the emissions side, the poster presents information on measurement methods, and:

- Differences in results for peak load vs. baseload-type programs
- Differences in results by valuation method

The comparisons provide guidance on the differential impacts of effects based on program type and design. The results also have implications for state or local agencies that may have development or sustainability goals.

# **Failure to Follow-Through: Trends in Completion Rates of Residential Renewable Energy and Energy Efficiency Projects**

*Eileen C. Hannigan, Wisconsin Energy Conservation Corporation, Madison, WI*

## **Introduction**

This poster examines trends in completion rates for two different programs: the Wisconsin residential renewable energy program and the Wisconsin Home Performance with ENERGY STAR (WIHPES) program. Combining U.S. Census data, survey data, and program participant data, the poster presents an analysis of possible factors affecting project completion rates.

## **Background**

Energy programs that offer potential participants incentives for taking the first step in installing energy efficiency measures or renewable energy measures run the risk of providing funds to customers who do not ultimately follow through on the installations. Analysis of these trends yields insights into improved program design to ensure maximum completion rates by participants.

## **Results**

While more households have been receiving WIHPES evaluations, the percentage of these households completing energy efficiency measures has been declining. Census block data show that households receiving evaluations tend to be in blocks that are wealthier than WI on average and households that install energy efficiency measures live in census blocks that are wealthier than those that do not install measures. Since 2003, homes in the census blocks of households receiving WIHPES evaluations have gotten older. However, fewer households in older neighborhoods are actually installing energy efficiency measures. Participants that are in older neighborhoods and do not install energy efficiency measures also have lower household income than other WIHPES participants.

Since 2002, residential customers in WI who are considering installing renewable energy technologies (solar electric, solar hot water, or wind) have been encouraged to receive an assessment of the suitability of their site for the technology. While the number of assessments conducted has been increasing, the percentage of these customers who install a renewable energy system has hovered below 20%. A recent survey of site assessment customers shows that these customers are wealthier, have larger homes, and are more likely to live in rural areas than the overall Wisconsin population living in owner-occupied housing. Customers who have installed a system are a bit wealthier, but otherwise similar demographically to those who have not installed a system.

When asked about the barriers to installing a system, about 40% reported not having adequate wind or sun on their site. Of those reporting adequate wind/sun, more than half of respondents rated the following as barriers to the installation of a system: initial cost (all technologies); locating installers (solar hot water); needing better price or technical information (solar hot water, solar electric); and zoning/permit problems (wind).

# Measuring The Impact Of Programmable Thermostats In Gas Heated Homes

*Tim Hennessy, RLW Analytics, Inc., Clark Lake, MI*

## Introduction

Manufacturers often market programmable or set back thermostats as a tool to help consumers save energy. The energy savings are achieved by reducing or lowering the temperature in a residence during specific hours, such as unoccupied or night hours. The current literature is mixed regarding the energy savings associated with programmable thermostats. The Environmental Protection Agency (EPA) has proposed to sunset the ENERGY STAR<sup>®</sup> labeling for programmable thermostats; “The decision to scrap the Energy Star thermostat specification was made after thermostat manufacturers failed to provide any data to show that installing ENERGY STAR thermostats results in energy savings<sup>1</sup>”.

## Methods and Results

To help provide meaningful input into this issue, GasNetworks<sup>®</sup> authorized *RLW* to conduct a survey supported billing analysis on a large sample of participants in the GasNetworks ENERGY STAR<sup>®</sup> Qualified Thermostat Rebate Program. The project used a test-control experimental design to help control for extraneous variables yielding net program impacts from the analysis. The primary objective was to calculate the net average annual gas energy savings for programmable thermostat program participants.

The study shows a savings of 80ccf, or 6.2% of total household annual natural gas consumption associated with the installation of an ENERGY STAR rated programmable thermostat. These savings are normalized to the installation of one programmable thermostat in a 2,000 square foot home with a pre-program normalized annual consumption (pre-NAC) of 1,287ccf. The savings are derived using a weighted least squares model. The relative precision associated with the savings is calculated to be  $\pm 23.7\%$ . This yields a 90% confidence interval from 61ccf to 99ccf or a percent savings ranging from a low of 4.7% to a high of 7.7% of normalized annual total household consumption.

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<sup>1</sup> December 2006 Energy Design Update, credited to Andrew Fanara, EPA project manager.

# **Quantifying a Moving Target: Challenges in Measuring Market Share for Market Transformation Programs**

*Kathleen Hunt, Enbridge Gas Distribution, Toronto, Ontario, Canada  
Laura Safrance, Enbridge Gas Distribution, Toronto, Ontario, Canada*

## **Introduction**

This poster presents Enbridge Gas Distribution (Enbridge)'s experience in measuring the success of the company's first Demand Side Management (DSM) market transformation program. The program's objective was to increase the market share of ENERGY STAR® windows in the company's franchise area in 2005 and 2006. There were no customer rebates issued or counted for this program, and therefore there was no definitive, internal tracking mechanism to measure window sales or market share changes. Consequently, post program research meant that Enbridge had to rely on the responses of industry manufacturers once again participating in this post-period survey. The poster discusses the marketing activities and market research processes and issues completed over this period pertaining to the ENERGY STAR® windows program.

## **Enbridge's Approach to Promoting ENERGY STAR® Windows**

Enbridge used a multi-faceted marketing strategy to increase market share of ENERGY STAR® over each twelve-month program period. Marketing tactics included introducing and promoting the ENERGY STAR® product to window manufacturers, encouraging certification by these manufacturers, and assisting in the education of manufacturers' customers (both residential homeowners and residential low-rise builders) about the benefits of installing ENERGY STAR® windows. Developing personal relationships with manufacturers and providing benefits to them from the study was critical to obtaining ongoing participation in the yearly surveys.

## **Issues Overview**

Enbridge faced five key challenges in measuring the market share for this program:

First, Enbridge faced the need to start program activities (in January) before the baseline information from the previous year was available. Secondly, Enbridge had to recruit a significant number of manufacturers (including key large manufacturers) in order to have an adequately sized survey population that represented market activity. Thirdly, the company's desire to recruit more survey participants over the period of the study conflicted with the requirement to use the same cohort of manufacturers for the pre and post analysis. Additionally, changes in personnel at the manufacturers can lead to misinterpretation of survey questions between the pre and post surveys hence skewing the results. Finally, another significant challenge Enbridge faced was the time lag in obtaining manufacturers' information from the previous year and the utility's regulatory requirement to submit a results report within a specified time period.



# **Predicting Naturally Occurring Energy Efficiency—Development and Application of a New Tool to Obtain Expert Input**

*Allen Lee, Quantec, Portland, OR  
M. Sami Khawaja, Quantec, Portland, OR  
Nicholas Hall, TecMarket Works, Oregon, WI*

## **Introduction**

Estimating what would have happened to a market in the future without a given efficiency program is often critical when program impacts are evaluated, particularly for market transformation, codes and standards, or long-term programs. Although various methods have been employed to estimate naturally occurring market adoption, they are often simplistic, not very transparent, or lack the input of knowledgeable experts. This poster discusses an innovative approach developed to estimate naturally occurring market adoption of efficient appliances and building measures.

## **Description**

We designed an innovative, web-based tool and assessment process for soliciting and analyzing experts' estimates of naturally occurring market adoption. This tool was applied to a codes and standards program to calculate how much the gross estimated energy savings should be discounted to account for naturally occurring adoption, and estimate net saving attributable to the program.

The tool is an interactive, web-based graphical display that allows experts to express their views on how market shares would have changed, over time, for energy-efficient measures if no program existed. We selected market and industry experts to provide input on nine different appliances and building efficiency measures. By adjusting three slider bars on a web page, experts were able to control the shape of a curve depicting their expectations of future market shares for the efficient appliance or measure they were analyzing. The shape was created in real time by a Bass-type logit market adoption equation using Flash animation. The Bass curve is the most commonly used, simplified estimator of product adoption rates and is well-tested in the market.

We estimated an “average” curve based on the curves generated by the experts when they selected three parameters defining the Bass curve. Using a limited Delphi approach, each expert then provided feedback on the comparison between the average curve and their submittal. The final curves were used to net out the effects of naturally occurring adoption from the gross savings estimates.

## **Findings**

We successfully developed and demonstrated this tool and approach, producing naturally occurring adoption estimates consistent with theories of market behavior. The biggest challenges were recruiting experts to provide their inputs and ensuring they had the appropriate knowledge to develop the most accurate estimates.

# **It's What You Do With You've Got, That Pays Off in the End Energy and Demand Savings Estimates with Parsimonious Data**

*Jim Mapp, Division of Energy Services, Madison, WI  
Barbara Smith, Division of Energy Services, Madison, WI*

## **Introduction**

Research found that reliable savings could be estimated for a program with limited data collection. Annual electrical energy savings and demand reduction were estimated using an incomplete sample and householder reported or field collected data. Results still produced realistic error assignments.

## **Methods and Analysis**

The specific example involves an appliance turn-in program that only recorded estimated age, size and type of appliance. Residential refrigerators and freezers were collected and data recorded on Brand, Type (such as Side-by-Side), Estimated Age and Estimated Volume. No other data was recorded such as name plate model and serial number, name plate location, color, design features or measured data such as two hour electrical usage.

The research concluded that reliable energy usage estimates can be made without monitoring data for the five major types of refrigerators and three types of freezers manufactured between 1940 and the present with adjustments for size from 7.75 cubic feet to 30 cubic feet of actual volume. The results can be used to estimate energy usage for units obtained in an appliance turn-in program and for turn-in and replacement programs implemented in low income weatherization programs.

The research also included a review of limitations of these estimates and additional opportunities for simplified savings estimates.

# **Back to the Future: Re-integrating Resource Planning with Open-Access Software**

*Paul Meier, Energy Institute, UW-Madison*

## **Introduction**

This poster presents the methodology for cost-benefit analysis of energy efficient technologies using a simple integrated resource model. The idea of evaluating demand side measures within simplified production models is not new. In the 1980s, “integrated” planning models substituted less-detailed analysis of both supply and demand side processes for the formerly onerous coupling of detailed end-use and production models. Industry restructuring resulted in practical challenges for estimating the avoided production and capacity costs displaced by energy efficiency. Efficiency programs were not effectively integrated within the expansion planning process and regional market operation complicated the estimation of avoided production costs.

## **Summary**

It is challenging to assess the grid-integrated impact for demand-side technologies within a supply-side system which changes throughout the installed technology lifetime. In the absence of state-of-the-art modeling capabilities, program administrators use screening metrics to select technology end-uses for various program objectives. This poster presents the methodology for cost-benefit analysis of energy efficient technologies which are “fully integrated” within the electric utility system using an integrated resource model.

The work presented characterizes the performance of multiple energy efficient technology examples. Avoided electrical generation is estimated in four time periods peak and off-peak seasons, and peak and off-peak hours. The benefits are estimated by evaluating an efficient scenario against a baseline scenario.

The baseline scenario is a pre-determined supply-side expansion plan which will characterize generation costs using a load duration curve and market price duration curve. The baseline scenario is compliant with planning criteria for a Wisconsin investor owned utility, including supply-side investments required to maintain a planning reserve margin, compliance with pending emissions limitations, and renewable portfolio standards. Uncertainty in demand growth, fuel prices, and carbon prices is considered. The benefits of the efficient scenarios include avoided fuel and operating costs, deferred capacity additions, avoided market purchases, and emission reductions.

The poster will consider the cost and benefits from the end-user, IOU, and societal perspective and will discuss the technical challenges and limitations of the assessment, including data availability and characterization of wholesale electricity markets.

# Mapping Software as a Program Management and Evaluation Tool

*Heidi Ochsner, Itron*

*Jennifer Holmes, Itron*

*Bob Ramirez, Itron*

*Dave Hanna, Itron*

*Shel Feldman, Shel Feldman Management Consulting*

*Judy Mathewson, We Energies*

## Introduction

Mapping software has been used to illustrate the distribution of program benefits for policymakers and, to a limited extent, the penetration of specific programs in the target market. Many utilities are also using mapping software to analyze grid characteristics and locate stressed transmission lines or site power generation facilities (both renewable and nonrenewable sources). The potential of the GIS (Geographic Information System) to aid in energy efficiency program tracking and evaluation has largely been underutilized, but in future evaluations could prove to be a valuable visual aid, revealing spatial patterns that are not easily recognized through traditional data analysis.

Geographically displaying program data can illustrate the distribution of current program benefits (i.e. program funding or energy and demand impacts), as well as identifying areas where significant energy efficiency potential remains. It can also be used to track program progress and to analyze market penetration of certain measure types. Program data combined with census data, energy use data, or other readily available information, can characterize regions and define spatial relationships between variables in order to obtain greater insight into a program's impacts. This poster demonstrates how GIS can support program tracking and evaluation efforts by using data from two utility programs as examples.

## Example 1: Agricultural Program (Efficient Dairy Equipment)

The agricultural program began in June 2005 and offers financial incentives to encourage the installation of energy efficient equipment at dairies. Program data are combined with USDA Census Data to illustrate the distribution of program benefits (energy and demand impacts) throughout the utility's service area. This example illustrates how GIS can be used as a program tracking tool to ensure the program is reaching areas where target customers are located, and to evaluate marketing strategies by monitoring demographic trends in program impacts.

## Example 2: Low-Income CFL Program

The low-income CFL program distributed CFLs to qualified residents as they applied for energy bill assistance through social service agencies. The distribution of CFLs was mapped and layered over the U.S. Census data for low-income neighborhoods to illustrate the penetration of program services in low-income neighborhoods within the utility's service areas. This analysis also indicates which social service agencies were most effective in distributing CFLs to low-income customers.

# **Taking a Bath on Showerhead Savings**

*Kathryn E. Parlin, Al Bartsch West Hill Energy & Computing, Chelsea, VT  
Robert Wirshafter, Wirtshafter Associates, Rydal, PA*

## **Introduction**

An innovative strategy, involving two separate study components, allowed us to calculate showerhead savings as one component of an impact evaluation for a low income program. It was virtually impossible to isolate these savings from other hot water measure savings in a regression model and knowing the value of this part of the package provides insight into the relative contributions of the other water heating conservation measures. The results led us to rethink what we know about showerhead replacements and provided valuable insights into possible modifications to field implementation.

First, we drew a two-stage cluster sample and requested randomly selected delivery contractors to collect all of the showerheads and aerators removed from participants' homes beginning on a specific day. These devices were sent to a testing facility and tested at four pressures, ranging from 20 to 80 pounds per square inch (psi). The costs for this component of the project came to about \$25,000 for the collection and testing of 474 fittings.

Translating these results into program savings required additional inputs, including accounting for the variations in flowing pressure at the participants' homes and the throttling of the high flow devices. The static and flowing pressures at the homes were collected during an on site survey of program participants fielded as part of the comprehensive impact evaluation, and external studies were used to fill in other critical data points.

The combination of the bench testing and additional on site data collection provides a solid basis for estimating the savings from the low flow devices installed through this program. This poster presents the results of these evaluation activities, including the distribution of flow rates, a comparison of the rated and actual flows, how changes in pressure affect flow rates, the range of flowing and static pressure measured on site, a summary of the method used to calculate savings and the energy savings estimated for showerhead replacements from this study.

## **Solar Incentive Structures and the Impacts of PV Performance and Costs**

*George Simons, Itron Inc.*

*Kurt Scheuermann, Itron, Inc.*

*Myles O'Kelly, Itron, Inc.*

*Marvin Feldman, Itron, Inc.*

*Pierre Landry, Southern California Edison*

### **Introduction**

This poster presents the results of a study conducted by Itron for the California Public Utilities Commission (CPUC) to examine the relationships between solar photovoltaic (PV) performance, costs, and PV incentive structures. Information is presented in two areas. First, the study provides a baseline of PV performance and costs using actual performance data and reported costs from a large number of PV systems installed and operating in California. Second, the study provides information on the manner and extent to which differences in PV performance and projected PV cost reductions can influence PV incentive payments. This study should help provide policy makers responsible for developing PV incentive programs with information that will result in incentive structures that fairly and transparently reward improved PV cost and performance while simultaneously providing a reasonable pathway to move PV towards an incentive-free market environment. PV performance monitoring data for over one hundred operating commercial, industrial, and institutional solar PV systems are combined with projected electricity retail rates and future PV costs within a breakeven levelized cost model to produce associated PV incentive levels. Preliminary results for 39 prototype PV market scenarios provide insights into how PV incentive levels can be set to take advantage of utility-specific electricity retail rates, PV configuration and location, and projected PV cost reductions while facilitating the development of PV systems that can compete without incentives. Potential implications of these performance and cost-effectiveness results are provided with respect to PV incentive programs and PV markets.

# Conditional Demand Analysis of Residential Energy Consumption

*K. H. Tiedemann, BC Hydro, Vancouver, BC*

## Introduction

Information on end-use energy consumption is used for power and natural gas system planning, load forecasting, marketing and demand side management. End-use consumption refers to the consumption of space heating, space cooling, water heating, lighting and other specific uses as opposed to total consumption. This paper summarizes the methodology and results of residential end-use studies for electricity and natural gas for British Columbia. The two studies use Conditional Demand Analysis (CDA) to estimate Unit Energy Consumption (UEC) values for residential end-uses. CDA is a multivariate regression technique which combines utility billing data with weather information and customer survey data. The CDA models integrate thermodynamic principles with household behavioral information. Saturation refers to the share of households with that end-use with all households with that fuel used as the base.

## Results

The studies generated UEC estimates (annual energy consumption per unit) for 14 electricity end-uses (kWh per year) and 10 natural gas end-uses (GJ per year), with results weighted to the customer population. The models perform well with adjusted R-squared of 0.83 for the electricity model and 0.85 for the natural gas model. Major electricity end-uses include primary electric space heating at 5,037 kWh per year, electric water heating at 3,186 kWh per year, secondary electric space heating at 2,310 kWh per year and lighting at 1,937 kWh per year. Major natural gas end-uses include primary space heating at 67.80 GJ per year, water heating at 20.76 GJ per year, fireplace logs at 15.77 GJ per year, and fireplace inserts at 15.77 GJ per year.

Table 1. End-Use Saturations and Unit Energy Consumption

End Use	Electricity		Natural Gas	
	Saturation (per household)	UEC (kWh per year)	Saturation (per household)	UEC (GJ per year)
Primary space heating	0.28	5,037	0.95	67.80
Secondary space heating	0.29	2,310	0.04	18.05
Fireplace insert	-	-	0.30	15.77
Fireplace logs	-	-	0.28	16.84
Central air conditioner	0.07	346	-	-
Room or portable air conditioner	0.14	207	-	-
Water heating	0.42	3,186	0.84	20.76
Refrigerator or freezer	2.11	1,112	-	-
Range, cook top or oven	1.07	721	0.18	8.48
Barbeque	-	-	0.10	3.12
Dishwasher	0.77	38	-	-
Clothes washer or clothes dryer	1.80	648	0.06	3.96
Lighting	1.00	1,937	-	-
Television	1.93	878	-	-
Personal computer	1.11	656	-	-
Pool	0.05	3,912	0.03	53.49
Hot tub	0.17	2,618	0.01	17.86
Total	-	12,744	-	105.0

# **Duct Soup: Research and Impact Results for Duct Sealing Programs**

*Elizabeth Titus, Northeast Energy Efficiency Alliance, Timothy Pettit, Nexus Market Research,  
Robert Wirtschafter, Wirtschafter and Associates*

## **Introduction**

Energy efficiency program administrators in many parts of the U.S. are developing or providing duct sealing directly, through home performance programs and in conjunction with central air conditioning replacements and new construction programs. The Northeast, in particular, is a region in which duct sealing has been added to the residential energy efficiency portfolio. Various delivery strategies exist. In addition, duct sealing is addressed in building energy code (Title 24) in California.

This poster presents the following: 1) Facts and figures about how leaky and/or poorly designed duct systems are a recipe for potential energy savings; 2) A menu of programs throughout the nation, factors that impact the types of programs that are provided, the level of participation by contractors and customers; and 3) Necessary ingredients to delivering a successful duct sealing program based on recent regional research efforts. This poster draws on experience from existing programs based on process and impact studies as well as on market research that explores issues influencing the success of developing a market for duct sealing. The poster essentially characterizes, compares and contrasts opportunities, barriers, and challenges encountered in various duct sealing program strategies, and presents various options to evaluate duct sealing programs.



# **CO<sub>2</sub> Trading Program Assessment: Recommendations for Kosovo**

*Dafina Gashi, Rochester Institute of Technology, Rochester, NY*

## **Background**

This poster will describe the methodology and results from research to assess Kosovo's future potential for establishing a CO<sub>2</sub> trading program. Kosovo is rich in geological resources, having world-class deposits of lead-zinc-silver and lignite. Kosovo has huge exploration potential. In addition, Kosovo has an abundance of renewable land and water resources. If properly developed and managed, these resources could serve as the foundation for Kosovo's economic transformation. Of all the development challenges facing Kosovo, formulating an efficient and effective energy policy poses perhaps the most immediate promise and greatest challenge for Kosovo's government. A lack of a consistent supply of electricity, coupled with political issues, has hindered business development particularly manufacturing enterprises and high potential foreign and national investments.

Kosovo is fortunate to have one of Europe's largest resources of lignite-grade coal, but the proposed development of this important indigenous fuel for the generation of electricity implies significant increases in the emission of carbon dioxide (CO<sub>2</sub>). Kosovo is expected to apply for the status of candidate for membership into the European Union (EU) upon its independence, which will require convergence with European standards for emissions and participation in CO<sub>2</sub> trading. Fulfillment of international criteria and standards are of great significance, as Kosovo's admission to the EU Community will possibly coincide with the new lignite power plant Kosovo C, expected to be built in 2020. The calculation of Kosovo's CO<sub>2</sub>, as well as future allocation by the EU, will be a subject of major impact on the country's economic growth, security of supply, and environmental protection and cooperation.

## **Approach**

An international comparative analysis of CO<sub>2</sub> emission trading programs and auction systems will assist in building Kosovo's capacity to meet future energy sector standards. The comparative analysis will include well-established European and U.S. state programs, as well as programs initiated in developing nations. Germany and Greece, Europe's top two lignite producers, will serve as examples from which lessons can be derived. An exhaustive literature review will compile program details, geographic information, natural resources and other important conditions specific to the nation/state as well as published program results. The literature review will be presented in a trading program matrix in order to provide a more simplified program assessment.

Additionally, an evaluation of Kosovo's current energy policies, along with the political, economic, and environmental conditions in Kosovo, will provide the necessary information to determine Kosovo's future potential for establishing a CO<sub>2</sub> trading program. Recommendations and lessons learned for Kosovo will also be presented.

# **Willingness to Pay for a Clear Night Sky: Use of the Contingent Valuation Method**

*Stephanie Simpson, Rochester Institute of Technology, Rochester, NY*

A clear night sky is a public good, and as a public good government intervention to regulate it is justifiable. Light pollution decreases the ability to view a clear, unobstructed night sky and can have energy related, biological, human health, and scientific consequences. In order for governments to intervene more effectively, an economic analysis of light pollution with regards to costs and benefits needs to be performed. This poster describes the use of the contingent valuation method to place an economic value on light pollution. Using the payment card method, students in the RIT community were surveyed regarding their willingness to pay for a clear night sky. Students were asked their willingness to pay for two improvements and one worsening in the level of light pollution, with the most frequent response being \$0. The means and other descriptive statistics of students' WTP responses are interpreted. This poster also describes interval censoring and Tobit regression analysis techniques used to represent the WTP responses of the survey population.