Foreword

Welcome to the 1998 ACEEE Summer Study on Energy Efficiency in Buildings, the tenth in a series of biennial workshops devoted to technology, policy, and implementation issues related to energy use in buildings. This week-long conference brings together a diverse group of professionals from around the world representing the views and expertise of utilities, industry, national laboratories, government agencies, public interest groups, and universities.

The theme of this Summer Study is ***Energy Efficiency in a Competitive Environment***, reflecting one of the major trends in the field of energy efficiency—the growing need to strategically position energy-efficient and renewable energy technologies in ways that harness market forces. Restructuring of the electric utility industry and increased retail competition in both electric and gas markets has made it imperative to prove to consumers that energy efficiency improvements in buildings can constitute profitable investments. The need to compete in both domestic and international markets is forcing corporations and nations to focus on energy efficiency as a means of improving productivity and reducing costs. Across the globe, efforts to capture the benefits of energy efficiency are increasingly market-driven and market-based.

Other drivers for energy efficiency are also emerging. Of particular note are the environmental benefits of energy efficiency. Numerous studies have documented that energy efficiency is a highly cost-effective and politically palatable near-term solution for addressing global warming. In many countries, including the U.S., buildings are heated, cooled, lit, and powered primarily by fossil-generated electricity, making the buildings sector an important target for reducing greenhouse gas emissions through improved energy efficiency.

But there are also new and continuing challenges. The first decade of the next century promises to extend the current era of low energy prices. At the same time there is no perceived threat of near-term electricity shortages or oil supply disruption. With much of the public still unaware of how energy efficiency contributes to the environment, it is not surprising to find relatively little interest by citizens, corporations, and the government in saving energy for its own sake.

The downward slide of utility demand-side management investments that was so apparent at the 1996 Summer Study is continuing; however, in a few key states such as California and New York the decline is being offset by market transformation programs funded through public benefits charges. In response to such opportunities presented by electric utility industry restructuring, portions of the industry and its efficiency services subsidiaries are staffing up and forming strategic alliances to offer not only performance contracting, but also commodity sales, maintenance, power quality, load profiling, billing, metering, and other services to its customers.

Set against the backdrop of these trends, noteworthy technology developments and implementation progress have been made since the 1996 ACEEE Summer Study. A growing body of research expertise has been translated into innovative and advanced technologies that are now cutting energy costs in both residential and commercial markets. Examples include gas-driven heat pumps, duct diagnostics and sealing, and low-emissivity windows. The past several years have also heralded the rapidly growing use of information technologies in building construction, energy metering, energy management and control systems, and telecommunications. Another technical development is the expanded scope of energy efficiency activities to include building start-up and operations and maintenance, in addition to installing energy conservation measures. The result has been an improved ability to deliver long-term savings.

These market successes reflect the great progress being made in integrating industry and government research agendas, the growing role of energy service companies, the mainstreaming of performance contracting, and the maturation of market transformation efforts. They have also benefited from better alignment between energy efficiency and diverse goals such as indoor air quality and health; occupant comfort, amenities, and productivity; and peak demand reduction. In addition, recent successes

have capitalized on the growing understanding of how individuals and organizations make decisions that affect energy use (such as choice of building and lighting designs and the purchase of heating and cooling equipment) and the expanding field of knowledge of how energy is used in society.

All of these issues, trends, challenges, and accomplishments are discussed in the ten panels that comprise the 1998 Summer Study. Each panel deals with a particular cluster of issues and presents its papers in a separate volume of the proceedings. The ten volumes are as follows:

Volume 1 — Residential Buildings: Technologies, Design, and Performance Analysis

Volume 2 — Residential Buildings: Program Design, Implementation, and Evaluation

Volume 3 — Commercial Buildings: Technologies, Design, and Performance Analysis

Volume 4 — Commercial Buildings: Program Design, Implementation, and Evaluation

Volume 5 — International Collaborations and Global Market Issues

Volume 6 — Deregulation of the Utility Industry and Role of Energy Services Companies (ESCOs)

Volume 7 — Market Transformation

Volume 8 — Information Technologies, Consumer Behavior, and Non-Energy Benefits

Volume 9 — Sustainable Development, Climate Change, Energy Planning, and Policy

Volume 10 — Building Industry Trends

The 1998 Summer Study repeats the panel devoted to building industry trends, which was introduced in 1996. Several new topics have been introduced this year, including sustainable development, information technologies, non-energy benefits, and global market issues.

In closing, we would like to thank the 22 panel leaders who worked their way through more than 600 abstracts, shepherded nearly 300 papers through the peer-review process, and selected 30 displays. The ACEEE staff also deserve special recognition, in particular Glee Murray and Rebecca Lunetta, for their coordination of a complex of logistical details that must come together to make the conference a success.

Enjoy the conference.

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PANEL 4 INTRODUCTION

Commercial Buildings: Program Design, Implementation, and Evaluation

The papers in Panel 4 focus on the projects, programs, or ideas related to improving the efficiency of both new and existing commercial buildings. Common themes in many of the papers include:

- Marketing 101—Using basic marketing techniques to promote energy efficiency in lieu of customer incentives;
- Delivering Value—Expanding the scope of energy efficiency activities to include building start-up, operations, and maintenance, rather than just installing energy conservation measures; and
- Focusing on results—going from "paper" savings to long-term energy savings.

The first two sessions are devoted to program design; the next five describe various aspects of implementation approaches, lessons learned, and future trends; and the last two sessions are devoted to evaluation. Each of the sessions is described in some detail below.

Program Design

The first set of papers focuses on the basis of any marketing program—what factors affect a customer's decision when evaluating a product or service. While in the past, many folks in the efficiency community have assumed that the main decision criteria are economic, these papers discuss other criteria that affect customer choice. Rickard et al. discuss the relationship between the risk associated with energy efficiency upgrade investments and other risks that the financial community regularly evaluates, such as stock portfolios. Chao et al. present a strong argument to re-evaluate the commercial property appraisal process. The premise of this argument is that commercial building valuation is based on the property's net income. Energy costs, therefore, can influence the overall asset value of a commercial property, provided they are accounted for in the initial appraisal process. Finally, Brady and Dasher discuss the role of building commissioning as a loss-prevention strategy in reducing design professional insurance liability claims. Cumulatively, these papers illustrate that energy efficiency investments offer tangible benefits beyond direct energy cost savings to the building operator.

New construction poses unique challenges to a program designer. On one hand, it provides the unique opportunity to take advantage of benefits beyond direct energy cost savings. On the other hand, the design and construction processes confuse long-term benefits with short-term costs. Sai-Chew et al. discuss the role of architecture and technology, and how they can be combined in unique ways to achieve high levels of efficiency in new construction. Case and Wingerden describe a program developed for state buildings in Utah that provides an incentive for the design team to look at integrating technologies from the beginning of the design process. Finally, Cockburn et al. discuss a program that encourages new building owners to ask for an efficient product from their design team through owner incentives, with a particular focus on an exit strategy that leads to building energy code adoption. Together, these papers summarize the current state-of-the-art in new construction program design.

While the installation of efficiency measures has been the main thrust of many programs, customers are increasingly asking for services that provide value; i.e., align with corporate objectives and provide attractive returns. Cohen et al. discuss three such

activities that show promise in this area: performing profit analyses on energy projects using a customer's long established investment guidelines; providing design and implementation assistance for large energy projects; and establishing an on-line vendor referral service. Dodds et al. discuss the current state of commissioning in delivering real savings and comfort through assuring proper equipment operation. Finally, Lee and Selkowitz present a retrospective on integrated envelope and lighting systems for commercial buildings. These papers are examples of services that provide value beyond energy cost savings; i.e., supporting customer decisions and project design, project implementation, commissioning, and expanding services beyond those provided by an electric and/or gas utility.

Implementation

State and University Programs with Measured Savings papers present state programs in California and Tennessee and a university program at Stanford University in Palo Alto, California. Lew and Wang describe a program in California where the state monitored savings associated with retrofits installed in public facilities following energy audits. Edmunds and Haasl describe the evolution of existing-systems commissioning for Tennessee. Findings from the commissioning demonstration project are reported including costs, energy savings, and non-energy benefits. The paper describes how commissioning, performance contracting, and utility partnering in an atmosphere of deregulation might work together to provide Tennessee with energy-efficient and comfortable buildings. Gould describes the pitfalls and benefits of setting up an energy management program at a university and how the lessons learned can be transferred to diverse facility types.

Implementing Innovative Federal and State Programs includes U.S. Department of Energy's (DOE) Super Energy Savings Performance Contracts (ESPC), the U.S. Environmental Protection Agency's recently announced ENERGY STAR® Buildings Program, and California's state-wide lighting policy. Heshong et al. describe recommendations resulting from a comprehensive state-wide study of patterns of lighting energy use. In the study, detailed baselines of lighting energy use were created for both residential and commercial lighting, using extensive on-site surveying and metering data. Hicks and Clough discuss the assumptions, application process, cost-effectiveness, and the assessment tool behind the ENERGY STAR® Building Label. Finally, Dahle presents the results of, and linkages between, the U.S. DOE's Super ESPC program and the U.S. Climate Change Proposal.

Building Case Studies: Successes and Lessons Learned papers present building or facility case studies. Gartland and Sartor provide information on 12 commercial buildings located in diverse climates to illustrate the benefits of performing an integrated retrofit. Allen et al. characterize the result of "Energy Efficient McDonalds"—energy efficiency measures incorporated into the demonstration restaurant and the performance results of these measures based on a calibrated model and supplementary field data. Sartor and Munn discuss the projects implemented at the Presidio of San Francisco and present the savings that were realized and documented through the monitoring and verification effort.

Commercial Trends. Davis and Swenson portray the data and trends found in the commercial building consumption survey from 1979 to 1995. Montross and Fraser describe the traditional approach to demand-side management in new construction and outline an alternative approach underway by Union Gas in Canada. Moezzi depicts the values and philosophies that underlie our cultural thinking on energy efficiency and energy conservation—therefore on energy policy.

Aggregating Purchasing is a subject of current interest because it can reduce costs and therefore lead to market transformation for efficiency and renewable technologies. Borg and Engleryd define aggregated procurement as either technology procurement (a method of pulling out technologies from the labs to the markets) or cooperative procurement (a method aimed at increasing the market share of already existing technologies). The paper describes an example of a cooperative procurement for the city of Stockholm and discusses barriers to doing aggregated procurement on an even larger scale. Coleman makes the argument that consumers face significant transaction costs related to searching for and analyzing information on prospective energy savings investments; and second, that even well-informed consumers still perceive higher risks in making energy-savings investments. He uses case studies to point out examples of where programs based on information dissemination have been successful at reducing the two market barriers of high "search costs" and "perceived risk." Dandridge addresses the barrier of marketing and outreach costs. These costs are comparable for small and larger businesses but the advantages to the small business are

much smaller. For small businesses, the costs of purchasing products and services during the project implementation phase is much higher because the small businesses do not have the same purchasing power as large businesses. The author describes the concept for a buyers club where an aggregation strategy is used to allow distributors to reduce prices by as much as 30 to 60 percent.

Evaluation

Evaluation of energy efficiency programs is evolving in response to the new competitive environment, which requires evaluators to grapple with increasing the scope of their evaluation, evaluating non-energy benefits, and declining evaluation budgets. In addition, evaluations must be performed in conjunction with program design and marketing efforts to better inform program planners about changing market conditions. Finally, evaluating single buildings in a consistent manner that can be relied upon by the financial communities is emerging as a unique need.

Evaluation methodologies are evolving in response to these challenges. Newberger discusses the results of streamlining a major Northeast utility's evaluation process. This not only included re-evaluating the role of on-site based metering, but also shifting evaluation resources to project quality (project management, documentation, and commissioning). Cavalli et al. discuss the role of multi-year billing analysis to estimate long-term effects of market transformation including free-ridership, spillover, and the persistence of savings. Finally, Schiller and Kromer discuss protocols for performing individual building evaluations for energy performance contracts. This discussion is based on evaluations done with and without common guidelines—measurement and verification protocols. These papers foretell a strong shift from measuring first year gross savings to a more targeted set of goals based on delivering value to the utility's customer, the public goods program, or enforcing the terms of the performance contract.

Evaluation results are the most compelling part of our work: Did we really deliver energy and environmental benefits and if not, why. The "why not" could range from customer incentive levels to evaluation protocols. Hart et al. discuss how the Eugene Water and Electric Board was able to deliver savings and reduce program costs by identifying an optimal level of customer incentive. Madison and Baylon discuss the impacts of the 1994 Non-residential Washington State Energy Code. The results focus not only on code compliance, but also on how effective different implementation techniques were in terms of delivering energy savings. Finally, Mahone et al. discuss the results of implementing California's CADMAC Protocols. This analysis is unique in that it evaluates a set of evaluation protocols, not the results of the programs.

These sessions are sure to provide a wide range of discussion from intuitive debates regarding the results to detailed discussions of econometric techniques.

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