

**2002
ACEEE
Summer
Study on
Energy
Efficiency
in
Buildings**

Teaming for Efficiency

PROCEEDINGS

Commercial Buildings: Program Design and Implementation

4

Panel Leaders:

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American Council for an Energy-Efficient Economy

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Foreword

The 2002 Summer Study on Energy Efficiency in Buildings, a biennial conference organized by the American Council for an Energy Efficient-Economy (ACEEE) brings together professionals from around the world to discuss the technological basis for, and practical implementation of, improving energy use in buildings. Participants, including authors of the papers published in these proceedings, represent government agencies, industry, utilities, national laboratories, universities, consultants, public interest groups, and others.

We selected the Summer Study's theme, "Teaming for Efficiency," to highlight the importance of public/private partnerships, regional collaborations, and inter-regional efforts. However, it is clear from the papers presented at this conference and published in these proceedings that the word "team" meant much more to our conference participants than the traditional definition with which we had started—a group of people joining together to bring a specific effort to fruition. The complexity and global nature of today's energy concerns calls for national and international collaborations and the linking together of fields of study and strategies which often evolve separately.

In addition to focusing on teams and partnerships collaborating on specific projects, papers in these proceedings highlight the importance of metaphorical teaming between many individual subjects. Lessons learned from the papers include:

- teaming between individuals involved in field measurements and analytical evaluations is key to developing new efficient products
- the integration of component technologies into building systems results in totals greater than the sums of the individual parts
- research and deployment efforts need to complement each other
- teaming of systems with operators through commissioning, load management, and the use of information technologies is key to realizing expected energy savings and curtailing demand
- teaming is key to getting the tools that support energy-efficient building design and construction into the hands of people who design, build, and operate buildings
- as witnessed in the subject of utility issues, the lack of teamwork and the absence of the ethic of collaboration for the good of society as a whole derailed one of the world's largest energy infrastructures
- the issue of teaming runs through the whole field of market transformation: defining market transformation is, in itself, a team effort, and market transformation programs inherently rely on team efforts to be successful. Advocates of energy efficiency must team with those working to improve the quality of the built environment because energy efficiency is inherently linked with increased comfort and productivity in buildings

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- teamwork between program developers and evaluators ensures that we learn from our mistakes and promote our successes
 - cross-cultural efforts lead to more effective programs

Finally, as global events this past year have reminded us, energy efficiency professionals are part of the team working to solve global environmental and security problems.

The subjects of the ten volumes in these proceedings are:

1. Residential Buildings: Technologies, Design, Performance Analysis, and Building Industry Trends
2. Residential Buildings: Program Design and Implementation
3. Commercial Buildings: Technologies, Design, Performance Analysis, and Building Industry Trends
4. Commercial Buildings: Program Design and Implementation
5. Utility Issues
6. Market Transformation
7. Information and Electronic Technologies: Promises and Pitfalls
8. Human and Social Dimensions of Energy Use: Understanding Markets and Demand
9. Energy and Environmental Policy
10. Program Measurement and Evaluation

At this 15th Summer Study, we offered participants a new presentation format—"Round Table" sessions. These sessions involved a full hour and a-half session within the topic area of each panel, and were designed so that industry and non-industry participants could collaborate on topic areas where issues are best addressed by a diverse panel of authors. Within each volume of these proceedings, you may find one or two such "Round Table" papers.

We, the Co-Chairs, would like to thank the 25 Panel Leaders who evaluated more than 600 abstracts, and selected and led 273 papers through a rigorous review process. We would like to thank the many peer reviewers who worked with the Panel Leaders through this process. Most importantly, we would like to thank ACEEE staff, in particular Glee Murray, Rebecca Lunetta, Renee Nida, Deborah Ziff, and Julie Harvell for their tireless efforts to make this an extremely successful conference and to produce these valuable proceedings.

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PANEL 4: INTRODUCTION

Commercial Buildings: Program Design and Implementation

The 65 billion square feet of commercial buildings that exist in the United States account for 17 percent of the total annual energy used. Transportation accounts for nearly 40 percent of the energy use; the residential sector uses nearly 25 percent. The commercial sector is the smallest sector in terms of energy use; therefore, it is arguably the least important segment on which to spend our energy efficiency program efforts. Add to that the fact that the commercial sector is also the one with the largest natural motivation for reducing energy costs, and it seems to make sense to put our energy efficiency efforts into transportation, industrial, or residential energy uses. So why are we still designing and implementing commercial building energy efficiency programs?

Over the next twenty years the total area of commercial space in the U.S. is expected to experience a net increase from 65 billion square feet to 90 billion, an average increase of 1.7 percent per year. Over the same period, the energy use of the commercial sector is expected to increase an average of 2 percent per year. Meanwhile, energy use increase in the residential sector (with a similar conditioned floor area percentage increase) will only be about 1 percent per year. By 2020, the U.S. economy as a whole is expected to use about 131 percent of the energy it uses today, while the commercial building sector will use over 140 percent of what it uses today.

Perhaps this seeming imbalance stems from an increase in plug loads as our businesses gain more computers and other electronic equipment. Perhaps it stems from a move in the economy from manufacturing to information, which would intensify the plug load issue. Perhaps it arises from a projected increase in air conditioning load, partially as an effect of the previous two potential causes, but partially driven by demographic and climate changes. Whatever the cause of this out-of-balance growth scenario in energy use within the commercial sector, it represents a real opportunity for improvement.

Most of the tools needed to make sure that additions to the commercial building stock are more efficient than the existing stock are already available. This Summer Study panel is focused on program ideas and efforts to ensure that those tools get into the hands of the people designing, building, and operating commercial buildings. Within this panel, we have reports on programs operated by investor-owned utilities, municipal utilities, third parties, and state and federal government agencies.

The mandates for efficiency programs have changed from “thou shalt, because it’s good,” to resource acquisition for a profit; to market transformation; to energy efficiency as part of a palette of benefits; to most recently, programs to garner immediate reductions in peak demand. The programs discussed in this panel were developed out of that progression in program mandates and ideals. Program designers have tried many different foci, from installing new, more efficient widgets, to “whole building” design goals, to a focus on ensuring performance-as-designed. Likewise, the tools used to bring about change have also been varied, including: bribes (incentives), design assistance, design centers, design competitions, builder and operator training, commissioning, collaboratives, and highlighting non-energy benefits.

The programs discussed in the papers in this panel exemplify some of the best efforts by a diverse set of players to increase the adoption of energy efficiency in commercial buildings. The papers were organized into groups that take you through many of the primary issues in the design and implementation of effective commercial energy efficiency programs.

MEGAWATTS of Energy (Efficiency)

In 2001, the West Coast braced to suffer some of the worst electricity shortages ever experienced in the United States. One response was to design programs almost entirely around achieving the greatest amount of demand reduction in the shortest possible time. Details on the design and implementation of three such programs are reviewed in papers by Cenicerros et al., Hart et al., and Corfee.

Shed Some Light/ Raise the Bar

Lighting in our workspace: it’s time to improve what we have and what we do. But how? We can prepare for the advent of new light sources. We can develop criteria elevating designs for lighting comfort, efficiency, and quality. We can combine lighting improvements with all other potential efficiency gains into one package. The stage is set for market change and replication in papers by Lucas et al., Mosenthal et al., and Janeiro et al.

Commercial Building Players: Playing Together

As in the entire building community, the commercial sector consists of a plethora of players, not all having convergent stakes or concerns. Background research and recommended methodologies to take advantage of this divergence for instilling efficiency into commercial buildings is provided in papers by Oh et al., Bordner et al., and Kunkle and Lutzenhiser.

New Technology, New Guidance, New Concepts

We learn how a new technology is making its way into the federal sector in a paper by Kline et al. Morehouse et al. describe how changes to federal guide specifications (already under way) can accelerate efficiency improvements to our largest single energy user. Tumidaj et al. tiptoe away from the federal arena and show what some utilities are doing to encourage large-scale retrofits in their service areas.

Is It Energy Efficiency? Or Is It Productivity?

Often, what efficiency program designers see as a program's goal is different from what actually motivates the target participant. Sometimes we see this early on; sometimes it occurs to us after the fact (of program implementation). Different perspectives on what a participant gets out of a program are shown by Brown, Diamond and Moezzi, and Pearson and Skumatz.

How Do We Get Them to Build Better Buildings?

Three very different approaches to increasing efficiency are presented by Eley and Pennington, Johnson, and Webb et al: strengthen state minimum standards, evaluate design and operation against other buildings and design intent, and involve the tenants directly in finding and implementing improvements.

Code Transformation: Is it Working?

Improving code floors and devising ways to implement changes in mandatory practice has always been challenging and, when successful, quite rewarding. Epstein et al. provide a methodology to support compliance, Mahone et al. discuss how one state is implementing its mandated efficiency improvements, and Matrosov et al. take a look at how code improvements are being addressed in Russia.

Lessons from Outside the U.S.

These papers provide a potpourri of programs studied and used in other countries. Larsen et al. give us a tour of Denmark's energy management practice in the manufacturing sector. Bagley et al. look at developing countries to learn what can be done to improve efficiency in their commercial buildings. Vongsoasup et al. examine Thailand's incentive programs.

New Efficiency Message Delivery Systems

When traditional methods of imparting information don't work as well as hoped, try alternative methods of sharing information. Collision et al., Dandridge and Mendez, and Robichaud present three innovative energy efficiency information delivery channels: the financial markets, peer-to-peer forums, and school curricula.

LARGE Nonresidential Programs

Three papers provide reviews of different approaches to relatively large commercial program designs. Van Holde et al. focus on a large metropolitan area, Marthews et al. look at a statewide program, and the Putnam et al. review a regional program that is in the process of going national.

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