

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

Teaming for Efficiency

PROCEEDINGS

Residential Buildings: Program Design and Implementation

2

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PUBLICATIONS: (202) 429-0063

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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 2: INTRODUCTION

Residential Buildings: Program Design and Implementation

The last several years have seen a renewed commitment to residential energy efficiency from a number of parties and for a variety of reasons. In California, the power constraints of 2001 required massive energy expenditures by the state and utilities to help forestall more serious reliability problems. In Texas, earlier restructuring legislation has begun to bear fruit in the development and implementation of several residential energy efficiency initiatives, two of which are documented in this panel. In the Northeast and Midwest, market transformation programs continue to evolve to address lighting, appliances, windows, and new construction efficiency opportunities. In the Southeast and Southwest, efforts to more broadly address residential energy efficiency efforts are slowly developing momentum, with an initial focus on new construction and windows.

Among the more notable regional successes in this period is the Northwest's effort to transform the residential windows market. This effort was sufficiently successful by 2001 to allow program support to be withdrawn, having attained a market share for ENERGY STAR® windows of approximately 70 percent. Further evidence of recent program successes can be seen in the market shares for ENERGY STAR appliances in California, New England, and the Northwest where market shares for some ENERGY STAR appliances are over twice the national average.

As documented by several papers in this panel, ENERGY STAR is playing an increasingly important role as a brand for consumers to equate with energy efficiency and with quality—whether it is for lighting, windows, appliances, or new homes. Manufacturers, builders, and retailers are increasingly using the ENERGY STAR label to differentiate their products. They are working with each other and with utilities, regional market transformation groups, and state agencies to jointly promote the ENERGY STAR brand concept to an increasingly aware and knowledgeable consumer audience.

In addition to voluntary energy efficiency program activities, residential building codes help make permanent progress in upgrading minimum energy efficiency levels of new construction. Acquiring greater energy efficiency beyond minimum code levels can be attained in conjunction with other above-code programs that make use of incentives and other financial mechanisms.

Evolution of ENERGY STAR® Homes: What's New and Changing?

Over the last six years, ENERGY STAR has been working with builders to provide homes that are easily identifiable as energy efficient. Many lessons have been learned along the way that are currently being incorporated in ENERGY STAR programs across the country. Papers by Rashkin, Werling and Passe, and Howes et al. review some of these lessons and how ENERGY STAR programs are evolving to better meet the needs of builders and consumers. The papers describe successful sales techniques that can eliminate the need for rebates, compare and contrast distinctly different ENERGY STAR programs for new construction, and discuss the need for ENERGY STAR to remain cognizant of the increasing stringency in new building energy codes being adopted by many states.

Increasing Consumer Awareness of the ENERGY STAR Message— Lessons Learned

A continuing trend with utilities and market transformation organizations in the U.S. is to move away from the use of incentive-based programs toward those that are focused on marketing directly to consumers to build awareness and demand for ENERGY STAR products. There are many challenges that need to be overcome to successfully reach consumers; however, excellent examples exist of programs that have successfully used a variety of marketing strategies. In a “Round Table” presentation, Sanders et al. discuss experiences developing and implementing a diverse set of ENERGY STAR programs directed at end consumers.

Impacts of Design Assistance and Licensed Programs on New Construction

Experience has shown that it is imperative for energy efficiency products and design features to be considered as early in the design process as possible in order to avoid lost opportunities, since they are much more costly to address after a building is constructed. Two papers present very different approaches to facilitate the design and construction of energy-efficient single-family and multifamily buildings. Kelsey and Vance review lessons learned from a free customized energy efficiency design assistance program that was offered by the City of Oakland to property owners, developers, and designers involved with new construction. Comprehensive green building programs are beginning to move into the mainstream, particularly in the new construction market. Banks and Katz review the green buildings movement and discuss one particular program, Earth Advantage, that can be licensed by organizations wanting to adopt a comprehensive green building program.

Ingredients to Making Residential Building Energy Codes More Effective

The energy-efficient design and construction of new residential buildings is a vital part of an effective energy, economics, and environmental strategy. Through effective design and construction of new houses, less energy is used, thereby reducing energy expenditures and environmental pollutants. Because the marketplace does not uniformly secure energy-efficient design and construction on its own, minimum requirements have been established through the use of energy standards and codes. In a “Round Table” presentation, Halverson et al. provide a brief history of the evolution of residential building energy codes and discuss the need for effective implementation and enforcement. The role above-code programs can play in helping to continually increase the stringency of building energy

codes is also reviewed. The authors also discuss the critical role sound building science practices and a systems approach to construction can play in effectively improving the energy efficiency of buildings.

Enhancing Energy Efficiency in Multifamily and Community-Based Programs

The need for affordable, multifamily new construction is critical in many parts of the country. Residential multifamily construction budgets are primarily influenced by first-cost considerations, which present a significant challenge to incorporating energy-efficient products and design features. Two papers review some of the unique market characteristics and market barriers that impact the incorporation of energy efficiency into multifamily new construction projects. However, the good news is that there are some successful examples of how projects can be funded through innovative programs. Erlich et al. review a successful utility-funded design assistance and incentive program that was crafted to address some of these unique challenges. Bloom et al. review a case study of an affordable housing renovation/rehabilitation project that incorporated sufficient energy efficiency features to enable the developer to request an adjustment of the “Utility Allowances” to reflect the savings. This enabled him to financially justify the project to investors, lenders, and the bond and tax credit allocation authorities.

Freyer et al. discuss how the Community Energy Cooperative that was formed by the Center for Neighborhood Technology is successfully using community-based efforts to optimize the delivery of its residential energy efficiency programs in four Chicago-area communities.

Spotlight on Residential Lighting

Significant advances have been made on the residential lighting front, but there still remains much to do. Three papers address several diverse residential lighting topics. Ihrig et al. describe successful efforts in the Northeast to promote compact fluorescent lamp (CFL) torchieres. The paper details both customer acceptance of the technology and the energy savings when these units replace standard incandescent and halogen torchieres. Vrabel et al. provide an overview of efforts to encourage builders, architects, prospective homeowners, and others to incorporate ENERGY STAR lighting fixtures in new residential construction. While success has been somewhat limited, the paper makes a number of recommendations on how to better penetrate this key market. Steele addresses an issue critical to the general promotion of CFL bulbs and fixtures—that the failure rate of these products has often been an issue with consumers, retailers, and program administrators. Using one of the largest available databases of CFL sales, this paper provides statistics and discusses the return and failure rates for a large variety of CFL products.

A National Tour of ENERGY STAR Home Programs: The Northeast, Wisconsin, and Texas

The ENERGY STAR homes program has begun to make significant progress in a number of regions throughout the country. Papers by Faesy et al., Ahrens et al., and Carroll et al. document three distinctly different approaches to promoting ENERGY STAR homes in the Northeast, Wisconsin, and Texas. Each of the three regions works with builders, raters, homeowners, and

others to increase the market share of energy-efficient new homes, but do so in different ways. Further, while ENERGY STAR serves as a common denominator for these programs, several of the programs promote, or require, additional changes to the homes to qualify for program participation. These include energy-efficient lighting and appliances, ventilation, furnace fan efficiency, and HVAC system sizing. Two of the programs—those in Texas and Wisconsin—have gone through recent program changes, some significant, and the papers discuss the underlying research and rationale for these changes.

Rounding Up the Energy Hogs: Approaches to Successful Refrigerator Replacement

The U.S. Department of Energy has relatively recently included refrigerator replacement as an eligible measure for federal low-income weatherization program funds. This has accelerated the need to develop quick and reliable field methodologies to assess whether a given, existing refrigerator can be cost-effectively replaced by a much more efficient new unit. Cavallo and Mapp, and Moore and Kinney, provide detailed overviews of various approaches to how this can best be accomplished based on actual program experience. The papers compare several assessment methods including short-term testing, replacement based on age, and replacement based on rated energy use. The pros and cons of each approach are discussed in the context of actual program administration.

ENERGY STAR Windows: Regional Views on Program Successes

Windows are one of the largest contributors to the heating and cooling loads of both new and existing homes. Tribble et al., Cerce et al., and Jennings et al. describe recently completed and ongoing efforts in the Northwest, Texas, Florida, and Massachusetts to promote ENERGY STAR windows. The papers describe three markets in very different stages of both program development and market share impacts. The Northwest program, in operation from 1998-2001, achieved a market share for ENERGY STAR windows that exceeded 70 percent. In Massachusetts, a more consumer-focused program has been in place for several years and may serve as the core for a more regional promotion of ENERGY STAR windows in the Northeast. In Texas and Florida, both of which had very low initial ENERGY STAR window market shares, efforts have recently started to work with builders, retailers, and others to promote ENERGY STAR windows.

Demand Savings and Direct Load Control

The objective of reducing the need for generation, transmission, and distribution capacity remains a goal of many utility, regional, and state programs. One way to accomplish capacity reductions is through direct control of consumer appliances and HVAC systems. Mecum provides a national overview of direct load control activities and provides a set of discrete recommendations for program administrators running such programs.

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