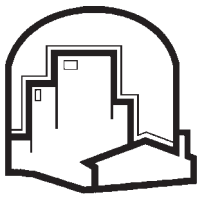
2000 ACEEE SUMMER STUDY ON ENERGY EFFICIENCY IN BUILDINGS



Efficiency & Sustainability

PROCEEDINGS

4 Commercial Buildings: Program Design, Implementation, and Evaluation

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Foreword

Responding to the theme of this Millennium Summer Study—"Efficiency and Sustainability"—professionals from around the world discussed the technological basis for and practical methods of implementing efficient and (hopefully) sustainable energy use in buildings. Issues, trends, challenges, and accomplishments were discussed. Each volume in this proceedings focuses on specific issues that encompass global visions for the future and discussion of future trends.

The 2000 Summer Study continued to emphasize new trends in buildings, equipment, markets, and social issues. Topics ranged broadly from the ENERGY STAR® program for new construction to building envelope and system engineering issues. The papers presented reviewed the latest information on utility restructuring and impacts on utility-sponsored programs, as well as global market issues, information technologies, and non-energy benefits. Sustainable development strategies; community-scale initiatives; factors influencing energy consumption and purchase of energy-efficient technologies; and how to design, implement, and evaluate energy programs were just a few of the cutting edge discussions that warm the mind and stir our quest for enlightment.

The subjects of the ten volumes in this proceedings are:

1. Residential Buildings: Technologies, Design, and Performance Analysis
2. Residential Buildings: Program Design, Implementation, and Evaluation
3. Commercial Buildings: Technologies, Design, and Performance Analysis
4. Commercial Buildings: Program Design, Implementation, and Evaluation
5. Deregulation of the Utility Industry and Role of Energy Service Companies (ESCOs)
6. Market Transformation
7. Information and Electronic Technologies
8. Consumer Behavior and Non-Energy Effects
9. Energy and Environmental Policy
10. Building Industry Trends

We, the co-chairs, would like to thank the 23 panel leaders who sorted more than 658 abstracts, selecting and nurturing 309 papers through the rigid review and publishing process, and selecting more than 60 talks for the poster sessions. We would also like to thank the many peer reviewers who worked with the panel leaders. Finally, a well-deserved thank you to the staff of ACEEE, in particular Glee Murray and Rebecca Lunetta (who received key assistance from Renee Nida and Julia Harvell) for their support and guidance throughout this process and for making the week a very successful "energy camp."

James McMahon, Lawrence Berkeley National Laboratory
Pat Love, Oak Ridge National Laboratory

Acknowledgments

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PANEL 4: INTRODUCTION

Commercial Buildings: Program Design, Implementation, and Evaluation

Sixty-three billion square feet of commercial buildings consume one-third of the total U.S. electricity production and have energy expenditures exceeding $99 billion dollars per year. These buildings are responsible for generating over 236 million metric tons of carbon emissions each year. More than 3.3 billion square feet of new commercial buildings were constructed from 1988 to 1998, with 170 percent more forecast by the year 2030. These buildings, and their energy and environmental impacts, are the focus of this panel.

The first commercial buildings, erected around 2000 BC, were simple structures representing the beginnings of architecture—a series of columns, walls, and roofs. Columns represented the upright human stance, walls represented human territoriality, and roofs both kept the rain out and created a crown, or head, for the structure. Walls also represented a separation of the human world from the plant and animal worlds. The walls of a courtyard formed a human space that became the city. While the form of buildings has evolved over time, buildings today fundamentally provide these same basic human functions—artistic expression, separation, definition, and shelter.

Modern buildings are fundamentally defined by the mechanical principles that drive their utility, with technology defining both the form of buildings and their energy use. Electrical lighting, mechanical ventilation, the architectural signature of the envelope, air conditioning, and office equipment all contribute to a modern building's energy consumption. Energy use in buildings has risen dramatically in the past 100 years because of technologies that enabled the creation of man-made indoor environments.

Since the advent of the air conditioning era, large cities developed in the southern latitudes because workers could remain productive performing office work regardless of the weather. This new technology also allowed greater architectural freedom. Post-World War II construction incorporated sealed aluminum and glass facades, or curtain walls. Larger floor cross-sections were possible and interior offices could be created with man-made indoor environments. These man-made environments have had a huge impact on U.S. economic competitiveness through increased productivity.

Recent experience shows commercial buildings can contribute to more than the basic human functions outlined above. They can support individual comfort, create a higher-quality work life, and increase productivity, thus helping to meet organizational goals. Finally, commercial buildings do this in a way that minimizes their impact on our environment.

The papers in this panel represent the state-of-the-art in program design, implementation, and evaluation designed to reduce the impact modern buildings have on the environment. The papers address ways buildings can deliver more for less through the application of modern technologies and practices. Finally, they give examples of ways in which traditional barriers to improved energy efficiency were overcome to achieve substantial gains in energy and resource efficiency.

Performance Contracting presents results of various efforts to create a market-based energy efficiency industry through performance contracting. These range from individual contracts that provide design team incentives to statewide programs aimed at small and medium commercial buildings.

Case Studies and Retrospects provides a look at the present and a look at the future of commercial building programs. These papers offer a thorough examination of the commercial building marketplace structure and the means aimed at influencing that market. The future is dealing with the question of how to change new construction program design to transform that market.

Commissioning/Retrocommissioning discusses one of the hottest topics in commercial building program design. The new Building Commissioning Association is discussed, as well as retrocommisioning programs underway.

Measuring, Verifying, and Paying discusses various methods to measure and verify energy savings. The ability to verify these savings is key to successful performance contracting and the lessons learned by these authors is invaluable.

Design Practices presents a series of programs targeted at designers, architects, and building owners. These programs must influence projects on a one-by-one basis and focus on daylighting, design integration, and green resorts.

A Taste of Local Codes discusses baseline practices from the building to the design team and how these practices relate to code. Two papers present the results of baseline studies in areas with strong building codes and discuss the implications of these studies on future code upgrades. The third paper discusses the process of developing an energy efficiency standard in Mexico and the lessons learned from that experience.

Energy Intelligent Schools includes a series of papers on influencing energy efficiency in schools. The programs range from fostering an energy ethic amongst maintenance staff to multi-resource efficiency programs that go beyond just energy.

Community Energy Savings Applications provides examples of community-based programs in the Americas. The papers discuss specific programs and present a strong case that buildings are integrally linked to the community—better buildings make better communities.

Government for Public Buildings presents the results of government-sponsored programs targeted at publicly owned facilities. These programs range from retrofit programs to government purchasing programs that focus on both federal and state procurement of energy consuming items.

Government for Private Buildings presents the results of government-sponsored programs targeted at privately owned facilities. The papers describe the results of programs from federal, state, and international agencies and their interaction with the private sector.

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