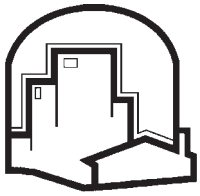
2000 ACEEE SUMMER STUDY ON ENERGY EFFICIENCY IN BUILDINGS



Efficiency & Sustainability

PROCEEDINGS

10 Building Industry Trends

Panel Leaders:
John Millhone, U.S. Department of Energy
Jerome LaMontagne, Brookhaven National Laboratory

ACEEE American Council for an Energy-Efficient Economy
1001 Connecticut Ave., N.W. • Suite 801
Washington, D.C. 20036 • (202) 429-8873
Publications (202) 429-0063
http://www.aceee.org

♻Printed on recycled paper.

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

Organizing Committee

James McMahon
Conference Co-Chair
Lawrence Berkeley National Laboratory

Pat Love
Conference Co-Chair
Oak Ridge National Laboratory

Rebecca Lunetta, Glee Murray, Howard Geller, and Steven Nadel,
American Council for an Energy-Efficient Economy

Advisory Committee

Gregg Ander
Southern California Edison Company

Morton H. Blatt
Electric Power Research Institute

Chris Chouteau
Pacific Gas and Electric Company

James Cole
California Institute of Energy Efficiency

Carl Duisberg
U.S. Agency for International Development

Margaret Gardner
Northwest Energy Efficiency Alliance

Peter A. Gravallese
NSPAN

Elizabeth G. Hicks
National Grid USA

Kathleen Hogan
U.S. Environmental Protection Agency

Martha Johnson
U.S. Department of Energy—Energy Information Administration

Richard Karney
U.S. Department of Energy—Office of Building Technology, State and Community Programs

Kenneth M. Keating
Bonneville Power Administration

Merle McBride
Owens Corning Fiberglas

Ron Nesse
Battelle Pacific Northwest National Laboratory

Elizabeth Shearer
Federal Energy Management Program

Laurie ten Hope
California Energy Commission

Gunnar Walmet
New York State Energy Research and Development Authority

Mike Weedall
Sacramento Municipal Utility District

Conference and Proceedings Staff

Glee Murray, *Director*

Rebecca Lunetta, *Manager*

Renee Nida

Eric Stragar

Julia Harvell

Thomas Boyle

Chuck Myers—Proceedings Design

Automated Graphic Systems—Proceedings and CD-ROM Production

Contents

PANEL 10: INTRODUCTION

Building Industry Trends

The issues driving changes in the ways energy is used in buildings have evolved rapidly over the past decade. Many areas that were once considered controversial, such as appliance and equipment efficiency standards, are now widely accepted and institutionalized, both in the United States and much of the rest of the world. While increases in energy efficiency through improvements in equipment and building shell performance continue to receive attention, concerns regarding global climate change and sustainability are causing increased interest in options that have the potential to address these challenges directly and forcefully.

This year's panel sessions devote considerable attention to renewable energy and cogeneration options. Two of the ten sessions are devoted exclusively to renewable energy, while one is devoted to combined heat and power (CHP) production. One session addresses the implications of the Kyoto Protocol, and another focuses largely on sustainability issues. The other sessions address specific issues in technology and regulation, and many of the papers in these sessions also have strong sustainability and/or carbon mitigation components. The contents of each session are briefly summarized below.

Refrigeration Trends provides overviews of the technical and economic impacts of the integrated use of engine-driven refrigeration with desiccant dehumidification, prospects for improving the efficiency of commercial packaged "rooftop" air conditioners, and the technical and economic potential of efficient options for meeting the rapidly growing demand for air conditioning in the southern European countries. The last paper deals explicitly with the carbon emissions related to increasing air conditioning demand, currently forecast to increase eleven-fold by 2010.

Combined Heat and Power proposes a set of fundamental definitions to clarify analysis of market issues relating to CHP and distributed power, discusses the implications of electric utility restructuring for CHP markets, and presents a novel technology for small-scale cogeneration combining a gas furnace with thermovoltaics.

Building Code Trends deals with a transfer of building codes from the United States to other countries, focusing on the recent initiatives in Lithuania and other Baltic countries. The paper describes how the building directives of the former Soviet Union are being modified to increase the thermal efficiency requirements and provide greater flexibility in building designs, and how design tools and training activities are being developed to support implementation and enforcement programs.

Commercial Building Trends presents overviews of trends in energy use in major types of commercial buildings, progress in the benchmarking of energy-intensive "high-tech" buildings (laboratories and cleanrooms), and the cooperative government/industry process of developing a "Roadmap to the 21st Century" for commercial buildings.

Building Envelope Trends provides summaries of new developments in building envelope technology, including the performance of autoclaved, aerated concrete walls ("breathing walls"), and the extent of thermal bridges in building envelope components.

Government Building Trends highlights opportunities for further energy savings in government buildings. An assessment of federal government buildings estimates that annual savings of $535 million are technically possible through continuing commissioning and major retrofits. At the state level, a paper describes the Tennessee energy management program, which has the target of a 20 percent reduction in energy use through energy efficiency in five years, plus an additional 10 percent savings from operation and maintenance measures.

Renewables I deals with the application of renewable technologies for two specific purposes—as an alternative to diesel power generation on Block Island, and to improve the disaster-resistance of communities by linking buildings and photovoltaics. The third paper in this session explores the broader implications of renewable portfolio standards as part of the process of electric utility deregulation.

Renewables II focuses on ground source heat pumps (GSHPs) and presents perspectives on the future of GSHPs in southern New England, highlights of the California GeoExchange Program, and prospects for improving GSHP efficiency through appropriate well field sizing and pumping optimization.

Kyoto: Let's Get Serious addresses policy issues associated with implementing the Kyoto Protocol. Topics include the role of carbon performance contracting in climate change mitigation, energy efficiency and sustainability under the clean development mechanism, and crediting energy efficiency measures under an emissions cap.

Trends, a summary session, provides an overview of prospective trends in building energy efficiency in the 21st century, a discussion on the potential cost-effectiveness of a sustainable society, and a bottom-up estimate of the aggregate heating and cooling loads of the U.S. building stock.

John Milhone, U.S. Department of Energy
Jerome LaMontagne, Brookhaven National Laboratory