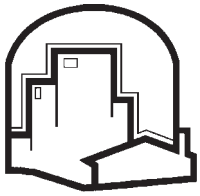
2000 ACEEE SUMMER STUDY ON ENERGY EFFICIENCY IN BUILDINGS



Efficiency & Sustainability

PROCEEDINGS

7 Information and Electronic Technologies

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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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Contents

Panel 7: Introduction

Information and Electronic Technologies

Our panel continues to explore an important new theme introduced at the 1998 Summer Study: the increasing presence and influence of information technologies and electronic equipment in buildings. This equipment, ranging from "smart," Internet-addressable microchips in fluorescent ballasts and home appliances to complex networks of sensors and controls that make up the energy management system in a large building, are clearly creating new opportunities to manage and operate buildings more efficiently and cost-effectively, with greater comfort, safety, reliability, and many other benefits beyond energy savings alone.

At the same time, computers and information technology (IT) equipment itself represents a major new electric and thermal load to be served within office buildings—and increasingly in many other building types: retail, industrial, institutional, and, of course, our own homes. Repeatedly in past years, projections of current trends have pointed to an inevitable and rapidly accelerating surge in electricity demand from IT "plug loads." And repeatedly, these dire predictions have been dampened (if not yet halted) by a combination of technology advances (smaller, faster, more portable, and smarter components and systems) plus joint initiatives by industry and government, most notably the introduction of low-power "sleep" modes stimulated by the ENERGY STAR® label on computers. But continued product innovation and the attractiveness and economic potency of new IT services remains a strong potential driver of growing electricity consumption as well as potential energy savings at a broader scale as economic activity at the margin continues to shift from physical production to information processing.

Finally, the rapid evolution of information systems throughout the larger economy is triggering fundamental changes in the buildings sector infrastructure, in ways that we are only beginning to understand. As information technologies evolve, along with communications networks that are increasingly broadband, multimedia, and globally interconnected, we are seeing fundamental changes in the ways business is done, the creation of entirely new business sectors (with 'e-tailing' as one obvious example), the creation of new lifestyle opportunities (such as virtual workplaces and virtual reality-based entertainment), and new consumer and business services that could have far-reaching consequences for both the expectations we create for the built environment and the technological possibilities to respond to these new demands.

It is hard to predict the eventual impacts of all this change, in terms of aggregate energy use, energy intensities, or the efficiency (economic and physical) of energy use. But the changes will continue, and bear close watching and rapid adjustments—proactive ones where possible—in energy efficiency policies, programs, and research priorities.

To stimulate our thinking in these directions, the papers presented here address three major themes:

- the direct use of electricity in buildings to serve IT and consumer electronics equipment;
- innovations in building design and management made possible by IT hardware and software; and
- the creation of new energy-related services and new business models directly related to IT innovations.

Electricity Use by Information Technologies

Rosen, Meier, and Zandelin present a detailed analysis of energy use by consumer electronics products in the United States, including the importance of standby losses as a component of the total (and rapidly growing) electricity demand by these products. Bertoldi, Conti, and Berrutto focus on opportunities for energy savings from reduced stand-by power in consumer electronics, and the process used in the European Union to cooperate with industry in developing effective energy-saving policies and programs to achieve these savings. Lebot, Meier, and Anglade also examine standby power in the home, both for consumer electronics and for the growing number of conventional home appliances with added electronic features (sensors, controls, timers, etc.); they extrapolate from results of several field studies to estimate aggregate energy use and greenhouse gas (carbon dioxide) emissions for all the OECD countries. Kawamoto et al. take a fresh look at aggregate electricity use by workplace computers and office equipment in the United States, updating an earlier analysis presented at a previous ACEEE Summer Study; the latest study includes the growing role of network equipment and two different scenarios for implementing power management. Nordman, Piette, and Meier address a specific, largely ignored aspect of energy-efficient operation of office equipment: field monitored data on practices concerning equipment turn-off at night, either by manual or automated means (versus leaving the equipment on 24 hours per day, with or without an automated low-power mode).

Innovation in Building Design and Management

Salsbury and Diamond present a model-based control scheme to improve control performance over traditional building control systems. Katipamula et al. present a conceptual design for extending the roles of facility management through a new framework that extends the current building control functions using fully distributed architectures. They contend that this will lead to interoperable devices with substantial benefits to the building industry. Yoshimoto and his co-authors discuss a novel means of disaggregating residential load monitoring data at the whole building level to the appliances and equipment in the home using neural networks. Rubinstein, Johnson, and Pettler present a concept for a low-cost building communications network for controlling building loads based on recently available networking technology. Kintner-Meyer examines ways to reduce capital cost of building EMCS by using the existing building data networks and wireless systems rather than the more traditional separate EMCS wiring system.

Brambley and Pratt discuss the use of automated diagnostic tools as a means of providing energy services such as continuous monitoring and diagnosis, remote problem detection, and continuous commissioning. Schroeder and Bradford present a model-independent tool for detecting faults and diagnosing problems within VAV terminal units. Piette, Khalsa, and Haves discuss the

demonstration results for a prototype building energy and performance data monitoring and diagnostics system as implemented in a test building.

New Energy Services and Business Models

Kromer and Kumar provide an overview and suggested typology for some of the new business models for energy-related services that are becoming available in an increasingly deregulated and Internet-oriented energy sector. Within this broader framework, Douglas, Howell, and Sick describe early experience with an integrated, Internet-based system for larger customers to analyze their energy use and competitively purchase electricity and fuel, while Wirtshafter, Radke, and Samiullah discuss a number of ways that geographic information systems (GIS) can help support market transformation efforts. Finally, Romm and Rosenfeld outline a thought-provoking view of some of the numerous ways that the emerging "Internet economy" may already be measurably changing our lifestyles, the structure of our economy, and—in consequence—our current and prospective patterns of energy use.

We believe that information technology and its implications for energy and buildings will continue to be an important theme for ACEEE Summer Studies for the foreseeable future. But how long will these merit a separate panel? The disappearance of this topic as a separate panel—and its infusion throughout all the others—might be a welcome sign that our thinking has begun to account for the reality that IT has become ubiquitous in the buildings sector.

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