Foreword

Welcome to the 1998 ACEEE Summer Study on Energy Efficiency in Buildings, the tenth in a series of biennial workshops devoted to technology, policy, and implementation issues related to energy use in buildings. This week-long conference brings together a diverse group of professionals from around the world representing the views and expertise of utilities, industry, national laboratories, government agencies, public interest groups, and universities.

The theme of this Summer Study is ***Energy Efficiency in a Competitive Environment***, reflecting one of the major trends in the field of energy efficiency—the growing need to strategically position energy-efficient and renewable energy technologies in ways that harness market forces. Restructuring of the electric utility industry and increased retail competition in both electric and gas markets has made it imperative to prove to consumers that energy efficiency improvements in buildings can constitute profitable investments. The need to compete in both domestic and international markets is forcing corporations and nations to focus on energy efficiency as a means of improving productivity and reducing costs. Across the globe, efforts to capture the benefits of energy efficiency are increasingly market-driven and market-based.

Other drivers for energy efficiency are also emerging. Of particular note are the environmental benefits of energy efficiency. Numerous studies have documented that energy efficiency is a highly cost-effective and politically palatable near-term solution for addressing global warming. In many countries, including the U.S., buildings are heated, cooled, lit, and powered primarily by fossil-generated electricity, making the buildings sector an important target for reducing greenhouse gas emissions through improved energy efficiency.

But there are also new and continuing challenges. The first decade of the next century promises to extend the current era of low energy prices. At the same time there is no perceived threat of near-term electricity shortages or oil supply disruption. With much of the public still unaware of how energy efficiency contributes to the environment, it is not surprising to find relatively little interest by citizens, corporations, and the government in saving energy for its own sake.

The downward slide of utility demand-side management investments that was so apparent at the 1996 Summer Study is continuing; however, in a few key states such as California and New York the decline is being offset by market transformation programs funded through public benefits charges. In response to such opportunities presented by electric utility industry restructuring, portions of the industry and its efficiency services subsidiaries are staffing up and forming strategic alliances to offer not only performance contracting, but also commodity sales, maintenance, power quality, load profiling, billing, metering, and other services to its customers.

Set against the backdrop of these trends, noteworthy technology developments and implementation progress have been made since the 1996 ACEEE Summer Study. A growing body of research expertise has been translated into innovative and advanced technologies that are now cutting energy costs in both residential and commercial markets. Examples include gas-driven heat pumps, duct diagnostics and sealing, and low-emissivity windows. The past several years have also heralded the rapidly growing use of information technologies in building construction, energy metering, energy management and control systems, and telecommunications. Another technical development is the expanded scope of energy efficiency activities to include building start-up and operations and maintenance, in addition to installing energy conservation measures. The result has been an improved ability to deliver long-term savings.

These market successes reflect the great progress being made in integrating industry and government research agendas, the growing role of energy service companies, the mainstreaming of performance contracting, and the maturation of market transformation efforts. They have also benefited from better alignment between energy efficiency and diverse goals such as indoor air quality and health; occupant comfort, amenities, and productivity; and peak demand reduction. In addition, recent successes

have capitalized on the growing understanding of how individuals and organizations make decisions that affect energy use (such as choice of building and lighting designs and the purchase of heating and cooling equipment) and the expanding field of knowledge of how energy is used in society.

All of these issues, trends, challenges, and accomplishments are discussed in the ten panels that comprise the 1998 Summer Study. Each panel deals with a particular cluster of issues and presents its papers in a separate volume of the proceedings. The ten volumes are as follows:

Volume 1 — Residential Buildings: Technologies, Design, and Performance Analysis

Volume 2 — Residential Buildings: Program Design, Implementation, and Evaluation

Volume 3 — Commercial Buildings: Technologies, Design, and Performance Analysis

Volume 4 — Commercial Buildings: Program Design, Implementation, and Evaluation

Volume 5 — International Collaborations and Global Market Issues

Volume 6 — Deregulation of the Utility Industry and Role of Energy Services Companies (ESCOs)

Volume 7 — Market Transformation

Volume 8 — Information Technologies, Consumer Behavior, and Non-Energy Benefits

Volume 9 — Sustainable Development, Climate Change, Energy Planning, and Policy

Volume 10 — Building Industry Trends

The 1998 Summer Study repeats the panel devoted to building industry trends, which was introduced in 1996. Several new topics have been introduced this year, including sustainable development, information technologies, non-energy benefits, and global market issues.

In closing, we would like to thank the 22 panel leaders who worked their way through more than 600 abstracts, shepherded nearly 300 papers through the peer-review process, and selected 30 displays. The ACEEE staff also deserve special recognition, in particular Glee Murray and Rebecca Lunetta, for their coordination of a complex of logistical details that must come together to make the conference a success.

Enjoy the conference.

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Acknowledgments

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PANEL 2 INTRODUCTION

Residential Buildings: Program Design, Implementation, and Evaluation

The residential sector is in a period of transition with respect to energy efficiency. Over the last two decades, the growing body of research expertise translated into new technologies that began to make an impact in the residential market. They have included low-e windows; high-density insulation; condensing furnaces; ground-source heat pumps; gas-driven heat pumps; air filtration control; duct design and sealing; high-efficiency appliances; software tools for design, energy rating, and retrofit; advanced customer research and program evaluation techniques; and innovative financing and contracting methods.

Residential programs, operated by utilities, weatherization organizations, government agencies, and energy efficiency product and service companies, have made progress in getting these products to market:

- Low-e windows now account for about a third of all residential window sales.
- In states like Wisconsin, condensing gas furnaces have a solid majority of the home heating market.
- In the Northwest, horizontal-axis clothes washers are already taking about 10 percent of the market.
- In the weatherization community, advanced audit tools and retrofit techniques continue to improve the cost-effectiveness of the federal Weatherization Assistance Program (WAP).

Utility programs have been a major source of funding and an opportunity for developing energy efficiency programs. Peaking at over $3 billion in the early 1990s, utility demand-side management (DSM) programs became the largest source of incentives and marketing support for residential energy efficiency.

Sustaining the gains of the last twenty years in energy efficiency will be a difficult challenge. The rapid proliferation of restructuring and increased retail competition in electricity (and some gas) markets since 1994 has caused most utilities to re-examine their DSM expenditures as part of a broader cost-cutting and reorganization effort in preparation for a less-regulated future. This trend undermines the integrated resource planning (IRP) paradigm that many states used to justify energy efficiency investments; with the scope of IRP severely reduced, DSM program budgets are falling rapidly.

Restructuring has left residential customers in a kind of limbo in some states. In states like California, Massachusetts, and New York, system benefits charges provide some continuation of historical DSM funding. Yet these funds are scheduled to last only about four years. In the meantime, few competitive power marketers have found a way to market lower-cost energy to residential customers; most of the competitive price offers have gone to larger business customers. In California and Massachusetts, grass-roots backlash movements are trying to overturn the recent legislation as unfair to consumers. So the benefits of utility restructuring to residential customers are still unclear.

Federal expenditures have not yet made up for the loss of utility funding. The only direct residential energy efficiency financing program (WAP) has suffered appropriations declines in recent years as Congressional budget-balancing efforts have cut discretionary spending. While support for pollution-prevention efforts (such as the U.S. Environmental Protection Agency's

ENERGY STAR® programs) has grown during the 1990s, their funding has come under increasing Congressional fire, especially as part of a growing backlash against the Kyoto Climate Change accords.

Low-income customers are perhaps most vulnerable in this brave new world. With federal funding in decline for weatherization as well as other social safety net programs, the ability of some households to afford energy bills along with other expenses is increasingly questionable. The future of utility low-income energy efficiency programs is unclear.

Panel Overview

The Residential Buildings Programs panel offers a number of insights into the issues raised by the larger trends described above. The sessions address a full spectrum of the residential market, from new construction to retrofit, and from lighting to HVAC. Some promising new directions for the future of residential energy efficiency are outlined in the following sessions.

Residential New Construction: What's Cool Is What's Hot covers a variety of important topics in the new-homes market: a California-based design program for summer-comfort homes that minimizes mechanical cooling; a modeling approach that projects the impact of various building industry trends on residential lighting; and an update on the ENERGY STAR® homes program, which is quickly becoming the largest new-home energy efficiency program in the United States.

Residential Retrofit: Doing It Right the Second Time describes two comprehensive retrofit programs, one aimed at typical single-family homes and one at manufactured homes. This session will provide insights into the technical and marketing challenges involved in addressing these very different markets. It also features an overview of residential retrofit programs and regulations around the United States.

Air Ducts: What's the Ceiling on Sealing? describes three different duct-sealing programs: a utility program aimed at the general single-family market; a market-driven program; and an effort aimed at duct sealing in manufactured homes. The technical as well as marketing challenges unique to each setting will provide valuable information to those who care about duct system efficiency.

Evaluation of Customer Response: Measuring Value and Other Imponderables showcases the use of advanced research techniques to examine customer perception and behavior. In three different contexts, this session looks at the issues of market penetration, willingness to pay, and perception of value by evaluating customer response to program offerings.

Evaluation of Program Impacts: Show Me The kWh (or therms, or Btu, or tons of carbon) presents several sides of impact evaluation: energy consumption impacts, ranging from a single end-use, single-market program to a community-wide program; and persistence issues, increasingly important in today's changing program management environment.

Financing, Rating, and Labeling: Life After Rebates. As cash rebates fade as the main currency of residential programs, financing and voluntary rating approaches become more important. This session examines selected facets of this complex topic area: lessons learned from heating, ventilating, and air conditioning (HVAC) labeling programs; application of energy rating tools to the development of standards for the ENERGY STAR® program; and the use of energy ratings for energy code compliance.

Performance Contracting: Getting What You Don't Pay For. Performance contracting is looked at as another post-rebate mechanism to market energy efficiency; however, its applications in the residential market have been rare. This session examines three unique markets that may hold potential for this technique: federally owned housing; private multifamily housing receiving public subsidies; and private single family low-income housing that normally would be covered under the WAP program.

Low-Income Programs: Shelter from the Storm examines issues and program design innovations crucial to the future of energy affordability for low-income people. One session describes in detail two innovative programs for low-income utility customers in New Jersey and Massachusetts. Another session delves into the broader issues of providing low-income energy services in a deregulated utility industry: it examines market characteristics of low-income customers; explores the potential impact of retail competition on low-income customers; and looks at low-income customer aggregation as a tool for developing market power.

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