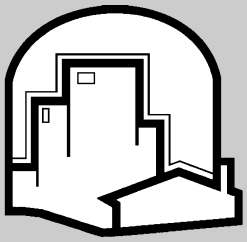

2002 ACEEE Summer Study on Energy Efficiency in Buildings

Teaming for Efficiency
PROCEEDINGS

Information and Electronic Technologies: Promises and Pitfalls

7

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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

- 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 7: INTRODUCTION

Information and Electronic Technologies: Promises and Pitfalls

The exponential growth in capabilities of information technologies might be a fascinating focus of attention at some other conferences. However, at the ACEEE Summer Study, that growth is accepted as the status quo. In Panel 7, the interesting and noteworthy developments in the world of information and electronic technologies have more to do with the impact that this enabling technology has on buildings and their energy performance. If the power of information technology suddenly exploded, and it were suddenly cost effective to equip every building with a supercomputer, would we instantly have better performing buildings? Probably not, because enhancing building performance through information technology requires development of intelligent applications that rely upon these technologies. There are also other barriers to the development and adoption of information technologies in buildings, such as cost of infrastructure, lack of incentive, inappropriate human interface, and the energy use of the technologies themselves.

For the 2002 Summer Study, the papers in Panel 7 fall into two major categories. The first set of papers describe some of the applications made possible by electronic and information technologies. The second set discusses some of the drawbacks and barriers to effective use of these technologies, and suggest ways to overcome these barriers.

Applications

The potential for improving program delivery and reducing costs through web-based applications appears to be large, but is mostly untapped. Benenson et al. describe a case study of how web-based technologies can support energy policy development. Berrutto and Bertoldi describe a new scheme under development in Europe for tradable green certificates for renewable energy and energy efficiency. Bartsch and Parlin describe how information technologies and the Internet can be used to better deliver services from demand-side management programs.

The availability of unprecedented amounts of data over the Internet has caused its own set of problems. An information-based solution cannot be considered successful unless it translates data into knowledge, decision making, and action. Several papers are focused on this topic. Foslien et al. describe the application of statistical techniques to the review of

customer energy consumption data in order to identify performance characteristics and detect opportunities for improvements. Kinney and Piette discuss tools, which are available or being developed, to benchmark large numbers of buildings in order to learn about their relative performance. Levi et al. describe a system under development to provide high-level management functions for fleets of facilities by interconnecting systems in the buildings. We anticipate that more such work will be done in the future to make beneficial use out of increasingly available performance data.

Another area of application for building performance data is control and diagnostics. Several papers describe some of the groundbreaking advances in these technologies. Li and Braun describe the use of on-line models in automated fault detection and diagnostics. Xu and Haves present the results of field testing of diagnostics methods using component-based models. Thomas and Soleimani-Mohseni describe how intelligent thermostats improve energy and control performance.

Barriers

The second category of papers in Panel 7 includes discussion of some of the barriers to the effective use of electronic and information technologies, and the drawbacks to these technologies. In every case, the papers focus on novel approaches to overcoming these barriers.

Several papers focus on the appropriate role for humans in building control. We typically look to advanced technology to provide solutions to our problems, although we must be aware that these technologies must be well integrated into human and social structures in order to be effective. In fact, some of the most promising solutions might involve developing systems specifically to enhance the performance of humans in providing solutions to problems, or modeling technology after human processes. Smothers and Kinney describe how human operators can most effectively detect problems in buildings when they are provided with high quality data presented in an effective format. Buckley and Proctor describe the integration of computerized and human expert systems to diagnose and repair air conditioning systems. The premise of the paper is that a human can be thought of as an essential component of a broader system to provide service. In a thought-provoking paper, Brambley theorizes on how the analogy with human signal processing can suggest directions for future control systems.

There are other barriers to using innovative technology, including a host of barriers to technology adoption. Bobker et al. discuss some of the barriers to development of technology for energy management in multifamily buildings, and an innovative community-based partnership that was formed to overcome these barriers. Michaels compares approaches to reducing efficiency market barriers through interactive software. Papamichael and Pal describe barriers in developing and using simulation-based decision-support software.

Another barrier to the use of advanced electronic technologies is their cost. While the benefits of smart control systems are significant, their cost can also be significant. Two papers discuss new technologies to reduce the costs of smart controls. Rubinstein et al. provide documentation of technology to reduce the cost of dimmable lighting systems. Kintner-Meyer et al. discuss the advances in wireless sensors technology, which should provide significant cost savings in sophisticated control systems. Both of these papers are updates from work

presented at the previous Summer Study, and show the amount of progress that has been made in recent years in this area.

Several papers discuss the dimensions of the standby power loss problem and strategies for implementing power management throughout the world. Ürge-Vorsatz et al. present a study of the impacts of standby power in residences in Central Europe. Based on a detailed survey of office equipment standby power in 2001, Roberson et al. describe the trends that are influencing office equipment power consumption. Nordman et al. contend that significant amounts of energy could be saved by simplifying and clarifying the power management interface. In a "Round Table" presentation, Bertoldi et al. present a global perspective on the issues of standby power, which they estimate is between three and 10 percent of total residential and commercial building use. This "Round Table" presents the most recent information about the magnitude of the standby power issue through the OECD (Organization for Economic Co-operation and Development) and China. The paper concludes with policy and strategy options that various countries are using to address the issue.

Two papers focus on other energy impacts of information technologies. Roth et al. present the results of a recent study of the energy consumption of 40 different types of commercial office and telecommunication equipment including power on and standby power rates. Finally, Stein explores the potential for significant increases in energy consumption as more data centers are needed to support the growth of the Internet. He describes technologies that will help to keep this growth in energy use in check.

Information technologies are beginning to radically change the way energy efficiency is delivered to the building sector, and the emphasis is on the word *information*. By sharing information in innovative ways, and developing ways to learn from and act upon that information, the energy use of buildings can be much more closely matched to the requirement for energy services. However, significant issues remain with the human factors, cost, and the efficiency and standby power management of the information and electronic equipment itself. We'll let the computer industry keep working on providing us with cost-effective supercomputers, but in the meantime, there is plenty of work to be done on improving the use of information and electronic technologies to enhance the energy performance of buildings.

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