Journal of Solar Energy Engineering

Editorial

A Message from the Special Issue Editor

The *Journal of Solar Energy Engineering* (JSEE) publishes Technical Papers of permanent interest in all areas of renewable energy and energy conservation as well as Discussions of policy and regulatory issues that affect renewable energy technologies and their implementation. Solar Energy has been defined in its broader context to include renewable as well as end-use efficiency. ''Energy Conservation and Solar Buildings'' is one of 13 topological areas of JSEE.

The present issue is a logical extension of a previous JSEE special issue edited by David Claridge (Vol. 120, August 1998) which covered ''Methods for Analysis of Measured Energy Data in Commercial Buildings'' largely meant to satisfy the exploding field of energy performance contracting. Papers in that issue covered various techniques for collecting field data, graphical display of data, energy use modeling of secondary building systems (using statistical regression, calibrated simulation and artificial neural networks), and determining energy savings and associated uncertainty resulting from various energy conservation measures in commercial buildings. Recently, another very important application area is slowly emerging: how does one design and operate buildings in an optimal manner during the course of their life cycle? The intent of this issue is to assemble a list of salient technical, both original and review, papers which center around the general theme: **Emerging Trends in Commercial Building Design, Diagnosis, and Operation**, and include various topics such as recent concepts in solar building design, operation of solar integrated photovoltaic systems, calibrated simulation of energy use in buildings, building commissioning, active and passive methods of controlling building loads either by using the inherent thermal mass of the building structure itself or by using cool storage systems, modeling and fault detection of chillers and air handlers, control of air distribution systems, distributed electrical generation, and issues in indoor air quality and mitigation techniques. A wide variety of modeling, analysis and optimization methods, both traditional as well as adapted from the domain of artificial intelligence, have been compiled in this issue, which includes 16 technical papers, and one discussion paper.

The magnitude of energy use in buildings and the extent to which it is used inefficiently is well known by professionals in this field, but much less appreciated by engineers and scientists outside this area. Several hundred billion dollars are spent annually in the U.S. to maintain engineered systems. In the residential, commercial, industrial and public works sectors, this number is about $120 billion/year. In the specific large commercial/institutional sector alone, which is the primary focus area of this issue, over $40 billion is spent annually, of which about $5.5 billion is in the HVAC&R area. Buildings in the U.S. consume about 36% of the total energy use (of which 14% is in commercial buildings) and 66% of the total electricity generated (of which 32% is in commercial buildings). Further, it is estimated that building energy use is the direct cause for half of the CO_2 emissions (which contributes to global warming) and a third of the SO_2 emissions (which leads to acid rain). Published reports and studies have consistently indicated that 15–25% of this energy use can be easily saved by state-of-the-art and cost-effective energy conservation and proper building operation practices. The Electric Power Research Institute (EPRI) estimates that 8–10% of the national energy budget for commercial buildings is related to inefficient operation of HVAC equipment. Additionally, using computer simulations and field measurements, EPRI estimates that changes in energy consumption in the range of 10 to 35% is not uncommon due to minor adjustments in equipment and controls.

The last two decades witnessed the rapid development of computer based applications and the corresponding permeation of decision support methodologies as reflected in numerous related disciplines and programs by federal agencies, private companies, and educational programs. Not only has this process changed the quantitative balance among the professionals involved in the development and maintenance of systems; but has also led to a transformation of *optimal design and operational mentality* of professionals working in different domains of engineering. It is no surprise, therefore, that there is increased emphasis on using *information technology* within the HVAC&R industry for scheduling, parts tracking, billing, and personnel management. This has provided an infrastructure and a higher expectation for the use of quantifiable information for better design, operation, control and decision-making of the various mechanical and electrical systems in buildings. Finally, the structure of the industry that provides services for the operation and maintenance of buildings is changing. Companies are consolidating and offering whole-building operation and maintenance packages. In addition, utilities are in the process of being deregulated and are beginning to offer new services, which could ultimately include complete facility management. The cost-to-benefit ratio for intelligent supervisory networks is improving as the industry moves toward large organizations managing the operations and maintenance of many buildings. Also, buildings of the future will increasingly use distributed energy production options such as micro gas turbines, PV and fuel cells coupled with more intelligent integration of building systems. The papers in this issue should be viewed against this backdrop of integrated design and intelligent operation of building systems.

The efforts of several people were critical in compiling this special issue. The authors are to be commended on meeting the various strict deadlines. Also, my sincere thanks to the various anonymous reviewers for their behind-the-scene devotion and time commitment necessary to assure the high quality of the printed articles. Finally, I would like to personally thank Dr. Jane Davidson, the Editor of JSEE, for not only suggesting the need for such an issue, but also for providing much needed advice and suggestions during the entire process of assembling it.

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