

Advanced Energy Systems Division

Newsletter (Summer 1999)

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Chair's Message

Karen DenBraven



It is my honor to welcome members of the Advanced Energy Systems Division as we enter into the year 2000. Looking back at my involvement over the past eight years, I have been fortunate to serve the Society and our members first within a Technical Committee, and later at the Division and Group levels. Change has indeed been a constant in our lives and the ASME. I am indebted to my predecessors who have left (figuratively) some very big shoes to fill. I would particularly like to extend my thanks to outgoing chair Mysore Ramalingam, who has done an excellent job in continuing the restructuring of the AESD. We have begun several initiatives, which I hope to continue during my tenure. These include the recently completed technical committee reorganization, and increasing cooperation with the Solar Energy Division.

The Division firmly believes that technical programming in the form of Conferences and Publications should be at the heart of our activities.

Our active Technical Committees include Systems Analysis, Heat Pumps, Direct Thermal Power Conversion & Thermal Management, Energy System Miniaturization, Fuel Cells, Hydrogen Technologies, MHD, and Superconductivity. We also have conference liaisons in Fluidized Bed Combustion and Stirling Engines.

In that light, we remain committed to supporting quality national and international conferences in the area of advanced energy systems. One of the highlights of this past year was a joint effort with the Solar Energy Division and our Japanese and Korean counterparts to organize and promote a conference on Renewable and Advanced Energy Systems for the 21st Century. This conference was successfully held on Maui in April 1999. The Division also continues its active participation in the IMECE.

One area of critical importance next year will be deciding the future of the Intersociety Energy Conversion Engineering Conference (IECEC). ASME and AESD have been key players in this Conference in the past, and intend to continue in that role. It has already been decided that the Division will withdraw from the current organization of the IECEC in three years. However, we have already agreed with two other active societies to pursue some other intersociety venue, whose structure is yet to be decided. This year's IECEC is being organized by SAE, and held in Vancouver, British Columbia beginning August 1. Further information about the conference may be obtained from the SAE website.

I would like to welcome our two incoming Executive Committee members, who have already been very active in serving the Division membership. Dr. Sriram Somasundaram works for Batelle-Pacific Northwest Labs, and has been the AESD representative to the IECEC Organizing Committee. He has graciously agreed to become our Member-At-Large for Programs. Dr. S. A. Sherif is with the University of Florida, and has most recently been the AESD Newsletter Editor. He will be our Member-At-Large for Honors and Awards. I certainly look forward to working with these two energetic gentlemen. I would also like to thank Dr. Mike Moran for all his years of service in various areas of ASME publications. His leadership helped produce and maintain a very high level of quality in our journal and magazine publications.

Anyone with an opinion or interest in any of these Technical Committees or Conferences is urged to contact either the appropriate committee chair or myself. You are also welcome to attend our Division meeting, which will be held at the IMECE this year in Nashville. I hope to see you there.

RAES Conference a Huge Success

Dennis O'Neal

The Advanced Energy Systems Division along with the Solar Energy Division of ASME hosted the conference, Renewable and Advanced Energy Systems for the 21st Century in Maui, Hawaii on April 11-15. Other sponsors of the conference included the Korean Society of Mechanical Engineers, Japanese Society of Mechanical Engineers, American Society of Heating, Refrigerating, and Air Conditioning Engineers, the Society of Refrigerating and Air Conditioning Engineers of Korea, and the Japanese Solar Energy Society.

The conference included 136 papers approximately evenly distributed between topics related to AESD and SED and three plenary sessions. Topics ranged from solar photovoltaic to heat pumps, to heat and mass transfer in energy systems. Twenty three of the papers were contributed by Korean authors and nineteen were contributed by Japanese authors. Attendance at the conference topped 160, which exceeded expectations.

One of the interesting plenary sessions was provided by Mr. David Hermance of Toyota who spoke on new automotive technologies that will be used in the 21st century. In the near term, his company and several others will be introducing electric hybrid vehicles capable of achieving 65 to 75 miles/gallon. He stressed that in the long term, they are looking to use fuel cells for the main power source in automobiles.

Publication Opportunities for AESD Authors

M.J. Moran

Several opportunities are available for AESD authors to publish their technical articles. These include symposia, the monthly Mechanical Engineering, and archival journals. AESD authors are cordially encouraged to give a tangible expression of their ASME affiliation by considering these publication outlets for their work.

Periodically, AESD has a special section in the monthly Mechanical Engineering. Special sections are comprised of articles submitted by various AESD technical committees on a rotating basis. Members interested in participating in this activity should contact the AESD chair and/or their Technical Committee chairs.

Opportunities for publishing technical papers are provided by the symposium volumes of papers presented at the International Mechanical Engineering Congress and Exposition (IMECE) AESD technical sessions. Normally one or more such volumes are prepared annually, comprising all the papers presented at IMECE. Such papers may be eligible for consideration for the prestigious E. F. Obert Award.

Symposium volumes are available for purchase at IMECE and also may be ordered directly from ASME technical publications. Abstracts are generally due in January for papers to be presented at the following IMECE. Authors wanting to participate in the IMECE should check the calls for papers in the monthly meetings calendar of Mechanical Engineering.

Many AESD authors participate in the annual IECEC held during the summer. Nearly every summer for several years AESD also has participated in symposia held outside the United States at various memorable sites. The 1999 event, ECOS '99 (Efficiency, Costs, Optimization, Simulation and Environmental Aspects of Energy Systems) was held in Tokyo, Japan in June, 1999. ECOS 2000 will be held in The Netherlands in July, 2000. Abstracts are due by 15 October 1999.

Papers for all such conferences are reviewed according to ASME standards and the symposium volumes are published variously by ASME or commercial publishing houses. For information concerning upcoming conferences, authors should consult the meetings calendar in Mechanical Engineering.

Additional outlets for technical articles by AESD authors are provided by the archival journals listed in the adjoining table. Owing to peer review requirements and some queuing of accepted papers before publication, a year to 18 months can elapse between paper submission and publication. Still, archival journals are the appropriate forum for

articles of enduring value. Prospective authors should see current issues of the journals for instructions concerning the submission of articles.

For answers concerning your questions about AESD publishing opportunities contact M.J. Moran (contact information available elsewhere in this newsletter).

Noam Lior Named Editor-in-Chief of ENERGY



Professor Noam Lior has been appointed as the new Editor-in-Chief of ENERGY- The International Journal. Dr. Lior is a Professor of Mechanical Engineering and Applied Mechanics at the University of Pennsylvania. He received his Ph.D. from the University of California, Berkeley. In addition to being the Editor-in-Chief of ENERGY, he is also the Regional Editor for North America and Europe of the Energy Conversion and Management Journal, and is a member of the Board of Editors of the Desalination, International Quarterly of Water Desalination and Re-use, and of the Russian Journal of Thermophysics journals. He served as the Associate Editor of the ASME Journal of Solar Energy Engineering and is a Fellow of the ASME. He has published widely in areas such as heat transfer, energy conversion, combustion, thermodynamics, and fluid mechanics.

ENERGY has a multidisciplinary focus on activities relating to the development, assessment and management of energy-related programs. The audience for this journal includes energy researchers, planners, industrial energy users and producers. More information on the journal can be found at: <http://www.elsevier.nl/locate/energy>. Dr. Lior can be reached at lior@seas.upenn.edu.

Somasundaram, Sherif Named to Executive Committee



Dr. Sriram Somasundaram is the new Member-At-Large for Programs. He has been a Staff Scientist in the Energy Division of the Pacific Northwest National Laboratory (PNNL) since 1989. He conducts research and has published extensively in the areas of energy conservation, thermal energy storage, and cogeneration technologies. He was recently elected as Fellow of ASME and is the AESD representative to the IECEC Steering Committee. He received his Bachelor of Technology degree in Aeronautical Engineering from the Indian Institute of Technology in Madras, India and his Ph.D. from Case Western Reserve University in Cleveland, Ohio.

Dr. S. A. Sherif will be the new Member-At-Large for Honors and Awards. He has most recently been the AESD Newsletter Editor. Dr. Sherif received his Ph.D. from Iowa State University, and is currently an Associate Professor of Mechanical Engineering at the University of Florida. Prior to joining the UF faculty, he served on the Mechanical Engineering faculty of the University of Miami (1987-1991) and Northern Illinois University (1984-1987). He is a faculty fellow of NASA-Marshall, NASA-Kennedy, Argonne National Laboratory, AFOSR, and the Arnold Engineering Development Center. Dr. Sherif has taught numerous courses in the applied thermal sciences and has published over 170 journal and conference papers. He has chaired several technical committees and advisory boards in the Heat Transfer, Fluids Engineering, Solar Energy, and Advanced Energy Systems Divisions of ASME, and technical and standards committees of ASHRAE. He also chaired various national and international conference organizing committees and has been an invited lecturer or panelist at international conferences, workshops and short courses. He is also the recipient of the 1997 E.K. Campbell Award of Merit from ASHRAE and a "TIP" Teaching Award from the University of Florida.

Spotlight on Advances in Heat Pumps

Vince Mei and Srinivas Garimella

Heat pump technology has been changing rapidly in recent years because of the advancement of technology, and more importantly, environmental concerns. The formation of the heat pump technical committee (HPTC) in 1987 was indeed timely. The recent national and global emphasis on energy efficiency and environmental impact of space-conditioning technologies has provided numerous exciting opportunities for heat pump research and development. New developments include novel working fluids, advanced electric and thermally activated heat pump systems, geothermal heat pumps, fundamental heat and mass transfer issues in heat pump components, system simulation, integration and implementation issues, and novel heat exchanger and compressor design. Even though HPTC is a relatively young technical committee, it maintains an active role in disseminating the latest developments in all theoretical and applications aspects of heat pump technology. The committee strives to help carry the development of heat pumps from theoretical concepts to widely implemented, practical and viable technologies, with a healthy mix of contributions from academia, industry and government agencies. The committee is well represented at the IECEC and IMECE, as well as topical conferences such as the recently concluded RAES in Maui, Hawaii. Five sessions, including a panel discussion with experts on Heat Pumps for the 21st Century have been organized for IMECE Nashville. The HPTC, through the Energy and Resource Laboratory in Taiwan, also sponsored four international sessions at the 1997 ASME Asia meeting.

Fifteen years ago, chlorofluorocarbon refrigerants (CFCs) were a major concern in the heat pump and air conditioning industry because of their ozone depleting potential, which resulted in a scheduled phase-out of CFCs and hydrochlorofluorocarbons (HCFCs). Research and development was focused on replacements of CFCs and HCFCs with Hydrofluorocarbon refrigerants (HFCs) and their mixtures. R-410A, a mixture of R-32 and R-125, for example, has been considered a long term replacement of R-22. Many research activities in this area are in progress. For the past five years or so, more attention has been focused on the global warming potential (GWP) of the refrigerants. HFCs are considered green house gases with GWPs typically a thousand times or more than that of carbondioxide. A popular concept of measuring a heat pumps' contribution to global warming is Total Equivalent Warming Impact (TEWI). TEWI combines the effect of the direct contribution from refrigerant leakage and the carbon dioxide emitted at the power plant in producing the energy needed to run the system. The contribution to global warming from the refrigerant for a heat pump is about 7%. Considerable attention is now focused on the lowering of GWP, and the HPTC has sponsored many sessions addressing new refrigerants.

Absorption systems are heat actuated heating and cooling systems that do not use any of the fluorinated refrigerants. They are therefore environmentally benign systems. Moreover, because they are heat-actuated, they have the potential to reduce peak electric loads. Recent developments in systems based on the generator-absorber heat exchange (GAX) and triple effect cycles, have greatly improved the system performance. Computer modeling of absorption systems is also making remarkable progress. Modular computer codes that allow users to design their own absorption systems are now gainly widespread acceptability. ASME conference sessions dedicated to the advancement of absorption heat pumps are sponsored annually by the HPTC.

Compressor technology has also noticeably improved in recent years. These improvements have occurred in all types of compressors including reciprocating, rotary, and scroll compressors. The newer scroll compressors have proved to be more energy efficient, lighter and quieter than conventional compressors, and are now being widely adopted by the heat pump industry. Several excellent papers on fluid mechanics and heat transfer in compressors have appeared at the annual HPTC sponsored sessions.

The HPTC would like to thank all its members, session organizers, and authors for their effort in making it one of the most active technical committees in the AES Division in such a short time span. We look forward to increased participation in the conference sessions and committee activities.

Technical Committee Activities

Direct Thermal Power Conversion and Thermal Management

Rahul Mital

This technical committee promotes R&D in the fields of direct thermal energy conversion and thermal energy transport. Technologies that convert heat directly into electric power without moving parts, such as AMTEC (alkali metal thermal to electric converter), thermionics, thermoelectrics and TPV (thermophotovoltaic) are covered. Additional information on AMTEC, Thermophotovoltaics, Thermoelectrics may be found at the following websites <http://www.ampsys.com>, <http://www.jxcystals.com>, <http://www.hi-z.com>, respectively. These technologies provide attractive features (high power density and reliability) for a number of spacecraft power systems, as well as for multi-fuel, portable terrestrial power supplies. Thermal management deals with all aspects of thermal management of energy systems. The committee participates in the IECEC and IMECE. Eight sessions were sponsored at the 1998 IECEC in Colorado with nearly 40 papers and three sessions were sponsored at the IMECE in California with 10 papers. This year DTPC&TM participated in the RAES conference in Hawaii also. Six papers were presented at the conference from this group.

Heat Pumps

Srinivas Garimella

Please see "Spotlight" elsewhere in this newsletter.

New Energy Systems Miniaturization Committee Formed

Richard Peterson

This new AESD committee was formed by individuals interested in the area of miniaturizing energy systems. While this subject area is broad, it may be described as energy systems smaller than traditional devices (e.g. the size of a sugar cube or smaller) and having a reliance on microscale structures for its operation. The term "energy systems" can be very inclusive, but should involve the concept of energy generation, use, distribution, and/or conversion from one form to another. These miniature energy systems are expected to provide a number of important uses where a premium is placed on either mobility, compactness, or point application of the function.

The committee will focus on providing a forum for individuals working in the area of energy systems miniaturization and to promote the area where appropriate. It will also be a source of information and expertise that other institutions and agencies can interact with. Two sessions are being sponsored by this committee at IMECE Nashville.

Superconductivity

Ming-C. Chu

The Superconductivity Technical Committee provides a forum for presenting the most recent progress in the field of applied superconductivity. The committee continues its activity in sponsoring paper sessions in collaboration with other ASME committees, particularly the Low-Temperature and Arctic Regions Heat Transfer Committee (K-18) of the Heat Transfer Division. Joint sessions on cryogenic heat transfer (1999 IECEC), and phase-change heat transfer at low temperatures (IMECE) are planned. New members are sought to bring in new ideas and to help coordinate future activities.

System Analysis

Hameed Metghalchi

During the previous year, this Committee organized the symposium "Thermodynamics, and the Design, Analysis, and Improvement of Energy Analysis", held during the 1998 ASME IMECE. The symposium included 32 papers divided into 8 technical sessions and two panel discussions on "Energy use and global warming" and "Thermodynamics needs in industry." The papers originated from 13 different countries, which maintains the tradition of international participation in this committee. The Committee is also a co-sponsor of the yearly ECOS (Efficiency, Costs, Optimization, Simulation and Environmental Aspects of Energy Systems) Conference, which will be held this summer in Japan. Amsterdam will host the ECOS conference in 2000.

A record number of papers (63) have been received for the 1999 IMECE and distributed into 12 paper sessions. Ten papers have been authored by industry authors; in addition, one of the sessions has a chairman and co-chairman from

industry. Forty-five of the papers (70%) have foreign authors. The symposium has been extended to include new topics (hydrogen, fuel cells, internal combustion engines) in addition to the more conventional topics (fundamentals of thermodynamics, thermoeconomics, energy systems analysis). A panel session entitled "High Efficiency and Low Carbon Technologies" will be held with participation from the government and private industry. The speakers will represent the power generation industry, the nuclear industry, the transportation sector, and the renewable energy industry.

The Committee modified its bylaws in order to have continuity in its operation. The Committee established an Executive Group made of Chairperson (1 year term), Vice Chairperson Administration (2 years term), Vice Chairperson Technical Programs (2 years term), Assistant Vice Chairperson Administration (2 years term) and Assistant Vice Chairperson Technical Programs (2 years term).

Hydrogen Energy Systems

Kirk Collier

The Hydrogen Energy Systems Committee is sponsoring a session at the International Mechanical Engineering Congress and Exposition to be held in Nashville TN, November 14-19. It is anticipated that the session will contain five papers ranging in topics from internal combustion engines to computer simulation of hydrogen leaks.

Other Committees

The AES Division also has other committees on Fuel Cell Power Systems and Magneto Hydro Dynamics. Contact information about these committees is provided elsewhere in this newsletter.

AES Division Extremely Active at IMECE Nashville (November 14-19, 1999)

Mark your calendars!

The AES Division has planned an active and stimulating technical program at this year's IMECE in Nashville. A total of 21 sessions including 3 panel sessions on current topics will be held. The 91 papers scheduled in these sessions include an impressive 55 from outside the US and 15 from industry, demonstrating the wide-ranging and global appeal of the technical topics being addressed by the AES Division. A list of session titles is provided below. Please be sure to participate in these informative sessions and add your valuable input wherever possible, especially during the discussion period at the end of each paper. We hope to see you there.

Systems Analysis Symposium Sessions

Fundamentals of Thermodynamics (2 sessions)

Fuel Cell Technology

Hydrogen and Renewable Energy Systems

Thermoeconomics

Internal Combustion Engines

Panel Session on High Efficiency and Low Carbon Technologies for the Next Millennium (2 sessions)

Thermodynamics of Power and Process Plants (2 sessions)

Energy Systems and the Environment

Energy in Education and the Environment

Thermodynamics of Energy Systems

Heating, Ventilation and Air Conditioning

Heat Pump Symposium Sessions

Heat-Actuated Heat Pumps

Emerging and New Technologies for Heat Pump and Refrigeration Systems

Fluid Mechanics and Heat Transfer in Positive-Displacement Compressors

Heat and Mass Transfer in Heat Pumps

Panel Discussion on Heat Pumps for the 21st Century

Energy Systems Miniaturization Symposium Sessions

Miniature Energy Conversion Devices (2 sessions)

AES Division Participation in IECEC

The AES Division is sponsoring several sessions with the Solar Energy Division at the IECEC in Vancouver, Canada, August 1-4, 1999. The year 2000 conference will be hosted by AIAA in Las Vegas, Nevada. Please see the Chair's message for future plans and the evolving role of the AESD in this conference. A list of session titles for the 1999 conference is provided below. Further information can be obtained at <http://www.sae.org/calendar/iec99tag.htm>.

Conversion Technologies

Stirling Engines

Advanced Cycles

Cogeneration and Heat Engines

Energy Systems

Cogeneration and Energy Conversion Systems

Electrical Power Systems

Storage Systems

Energy Conversion & Renewable Energy

Hydrogen Energy Storage and Utilization Systems

Photovoltaic Energy/Technology

Wind and Hybrid Energy Systems

Solar Thermal Energy

Energy from Waste and Biomass