



Newsletter of the ASME Solar Energy Division
Editor: Agami T. Reddy • SED Chair: Carl Bingham

FALL 2004

STATE OF THE SED • Message from the Outgoing Chair



Mark Thornbloom

It is an exciting time to be working in renewable energy, and your Solar Division has been busy. It's been some time since our last newsletter, but your Solar Division has been active advancing and promoting the art and science of renewable energy. We have embarked on some new initiatives, while maintaining our strength in our traditional core efforts. This could not have been done without the many hours of volunteer work that our members have contributed. But it's not all drudgery. I truly enjoy the interaction with my colleagues and friends, the knowledge I've gained reviewing my peer's papers, the satisfaction I get knowing that I am contributing to the dissemination of knowledge and the advancement of renewable energy engineering. And I encourage you to seek ways to get involved. While we are one of the smaller divisions within ASME, the technologies and research within our renewable energy scope are growing very rapidly outside US borders. In the coming years, we have a unique opportunity to help make ASME International truly international. Also, as part of ASME's Continuity and Change effort, your Executive Committee has been meeting with other ASME divisions to establish an ASME Energy Institute. This reorganization has the purpose of streamlining current operations to make us more responsive to our changing world, and hopefully to expand our exposure to our non-ASME col-

leagues in our respective fields, without jeopardizing or weakening our core activities.

Your Solar Division is guided by an Executive Committee, committed and experienced volunteers who have made a five-year commitment to rotate through each of the positions on the Committee. Since our last publishing, we have had two members rotate off: Stan Kleis started volunteering with the Solar Ponds & OTEC technical committee; J. Boise Pearson started volunteering with the Solar Space Applications technical committee. After each chairing several conferences and rotating through each of the positions as an Executive member, Stan and Boise have moved on to greener pastures. I hope that they do not feel "set out to pasture", because their contributions are sorely missed but I know that we can always benefit from their experience and time in the future. Meanwhile, I'd like to extend a big welcome back to Jeff Morehouse. This is his second time through the Executive Committee rotation, and we are looking to his experience and institutional knowledge to contribute an element of grounding to the Committee's decisions. You will find a report from Jeff later on in this newsletter giving us an update on the Solar Splash contest. Also, welcome to our new executive committee member Agami Reddy of Drexel University. Agami has served for several years as an Associate Editor on our *Journal of Solar Energy Engineering* and was Technical Chair for the 2004 International Solar Energy Conference (ISEC).

One of our core activities is recognition of talent. We continued our Graduate Student Paper Contest, awarding outstanding research by an ASME student member with a cash award and an opportunity to present his/her research at the ISEC. We continued

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the tradition by awarding Gunnar Tamm in 2002, Sanjay Vijayaraghavan in 2003 with Thomas Osinga as runner-up, and Nitin Goel in 2004. Applications are due by December 13, 2004 to Dr. Klett at www.asme.org/divisions/solar/awards/ and I encourage all our student members to apply. The Division also gives the John I Yellott award bi-annually to an outstanding individual who has contributed significantly to the Division and to solar energy research in general. This year I had the privilege of presenting this highest honor award to Dr. Jane Davidson at the ISEC in Portland. Also, for the past five years, Davidson has edited our Division's *Journal of Solar Energy Engineering*, perhaps the most enduring and important activity our Division has in disseminating renewable energy knowledge. During her tenure as Editor, she has greatly increased the readership and number of quality peer-reviewed papers published, without sacrificing quality of content. Sadly, her term ends this December, but after a long search, the executive committee was pleased to submit Dr. Aldo Steinfeld's name to the ASME Board of

• continued on page four

PUBLICATION OPPORTUNITIES FOR SED AUTHORS • Scope

Prof. Jane Davidson
*Editor, ASME Journal of Solar
Energy Engineering*

The *Journal of Solar Energy Engineering* 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 Scenery features photographs or graphical displays of research results and significant new solar installations or research facilities.

The Editorial Board, which includes the Editor Professor Jane Davidson from the University of Minnesota and thirteen Associate Editors who are responsible for topical areas in building and energy conservation, solar collectors, solar thermal power, solar space applications, solar chemistry and bioconversion, energy storage, testing and measurement, fundamentals and theory, system and component simulation, photovoltaics, wind energy, conservation and solar buildings, and emerging technology and policy. The Journal welcomes papers that introduce new fields or applications of solar and other renewable energies.

Currently, the Journal publishes one issue each year devoted to wind energy and a second issue that includes a special section on that topic. Other recent special issues have presented international research on building energy, solar thermal production of electricity, and solar thermal industrial processes.

Authors may submit articles for review via the Journal webtool at <http://journaltool.asme.org>. The Journal is published quarterly in February, May, August and November and is available in print as well as electronic media. To subscribe to the Journal •

SUMMARY REPORT • International Solar Energy Conference “Solar 2004” held in Portland, OR

Carl Bingham
*National Renewable Energy Laboratory
General Program Chair*

Agami T. Reddy
*Drexel University
Technical Program Chair*

The Solar Energy Division (SED) of the American Society of Mechanical Engineers (ASME) was a co-sponsor of the Solar 2004 Conference, A Solar Harvest: Abundant Opportunities. This forum combined the annual solar events of the American Solar Energy Society (ASES), the ASME Solar Energy Division, and numerous other organizations supporting conservation, solar and renewable energy.

The proceedings assembled peer-reviewed papers submitted to ASME and presented at the conference held from July 11-14, 2004 in Portland, Oregon. There was large increase in the number of international authors this year, partly because it was the first time that the ASME-SED went to a completely web-based paper submission and review process. The papers covered seven broad topical areas that include Conservation and Solar Buildings, Fundamentals and Theory, Heating and Cooling Applications and Analysis, Photovoltaics, Solar Chemistry and Bioconversion, Solar Thermal Power and Testing and Measurement. From about 150 abstracts received by ASME, about 90 articles were accepted following the peer-review process.

In addition to these papers, the technical content of the conference has been enhanced by other events sponsored by ASME, including a tutorial on Solar Production of Hydrogen. ASME also sponsored a session on Solar Energy Applications in the Caribbean, dedicated to the memory of Dr. O. Headley. ASME's Solar Energy Division gave its prestigious Yellott Award for service to the Division to Jane Davidson, Professor of Mechanical Engineering at the University of Minnesota, an ASME Fellow, who, as the editor of the *Journal of Solar Energy Engineering (JSEE)*, has been responsible for the dramatic growth of our Journal in recent years. •

SOLAR ENERGY DIVISION COMMITTEES 2004-2005 •

Executive Committee Members

- Carl Bingham, *Chair*, National Renewable Energy Laboratory, Golden, CO, 303-384-6390, Carl_Bingham@nrel.gov
- Scott Jones, *Vice-Chair*, Sandia National Laboratories, Albuquerque, NM, 505-844-0238, sajones@sandia.gov
- Jeffrey Morehouse, *Secretary*, University of South Carolina, Columbia, SC, 803-777-3017, more@enr.sc.edu
- Agami T. Reddy, *Member*, Drexel University, Philadelphia, PA, 215-895-1502, reddyta@drexel.edu
- Mark Thornbloom, *Past Chair*, Florida Solar Energy Center, Cocoa, FL, 321-638-1444, thornbloom@fsec.ucf.edu

Administrative Committees

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- Annual Report, Carl Bingham and Scott Jones
- Education, David Klett
- Program Chair, Scott Jones
- Energy Committee, Bob Boehm
- Congress Program Rep, Scott Jones
- Honors and Awards, Mark Thornbloom, J. Boise Pearson, and Stan Kleis
- JSEE, Jane Davidson
- Membership Devel., Agami Reddy
- Govt Relations, Tom Mancini
- Publicity/Newsletter, Mark Thornbloom and Agami Reddy

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- Mingsheng Liu, *Conservation and Solar Buildings*, Univ. of Nebraska, Omaha, NE, mliu2@uni.edu
- Robert Turner, *Fundamentals and Theory* University of Nevada at Reno, Reno, Nevada, rtturner@power.net
- Jorge Gonzalez, *Heating and Cooling Applications and Analysis*, Santa Clara University, Santa Clara, Ca, jgonzalezcruz@scu.edu
- Pali Singh, *Photovoltaics*, Villanova University, Villanova, PA, singh@ece.vill.edu
- Aldo Steinfeld, *Solar Chemistry and Bioconversion*, ETH-Swiss Federal Institute of Technology, Zurich, Switzerland, aldo.steinfeld@psi.ch
- Andy Hollerman, *Solar Space Applications*, University of Louisiana at Lafayette, Lafayette, LA, hollerman@louisiana.edu
- Chuck Andracka, *Solar Thermal Power*, Sandia National Laboratories, Albuquerque, NM, ceandra@sandia.gov
- Huanmin Liu, *Solar Ponds and OTEC*, University of Texas at El Paso, El Paso, TX, lhuanmin@utep.edu
- Andreas Neumann, *Testing and Measurement*, Deutsches Zentrum für Luft und Raumfahrt, Köln, Germany, a.neumann@dlr.de
- Scott Schreck, *Wind Energy*, National Renewable Energy Laboratory, Golden, CO, scott_schreck@nrel.gov

DEDICATION TO PROFESSOR OLIVER HEADLEY •

The ASME Solar Energy Division honored the late Professor Oliver Headley for his decades of service to the Caribbean region during the 2004 International Solar Energy Congress in Portland, OR. Prof. Headley worked as a chemistry lecturer and professor at the University of the West Indies, Trinidad campus for twenty five years before he served as Director of the Centre for Resource Management and Environmental Studies at the University of the West Indies in Barbados. He was a founder and president of the Caribbean Solar Energy Society, where he tirelessly promoted sustainable solar applications as diverse as drying, electricity, water heating and air conditioning throughout the entire Caribbean region. He was referred to as “a brilliant scholar, researcher, physicist, scientist, environmentalist, creationist, Christian and a humble man who never lost the common touch”.

He combined both scholarship and innovation displaying throughout his

entire career the qualities which the Caribbean region needs in order to move to the cutting edge of scientific enquiry. His engaging personality, energetic spirit and passion for solar energy were an inspiration to many. Indeed, his work has been recognized internationally and the legacy he has left behind will be appreciated by generations to come. He will be missed, but his work lives on through his many publications and many students who shared his passion and had the privilege of his tutorship. The ASME Solar Energy Division sponsored the session “Solar Applications in the Caribbean” in his honor, and commissioned a plaque to



In memory of Dr. Oliver Headley. *From left; Mark Thornbloom SED Chair; Karim Altaï and Ramiro Rivera, co-authors, James Husbands, author; Onaje Jackson, co-chair of the session, and Jorge E. González—author and co-chair of the session.*

be displayed at the University of the West Indies in his memory. The session had six technical papers reviewing applications of solar energy in the Caribbean. The topics included biomass, solar air conditioning, solar water heating, and assessment of solar energy in the Caribbean. •

CEDARVILLE UNIVERSITY WINS 2004 SOLAR SPLASH • *The World Intercollegiate Solar Boat Competition*

Cedarville University of Cedarville, Ohio is the 2004 Collegiate Solar Boat World Champion as the overall winner of the 11th annual Solar Splash, the world intercollegiate solar boat competition, held in Buffalo, NY on June 16 - 20. The 5-day event drew applications from 27 teams from the USA and Canada, with 17 boats qualifying to participate in the competition. The boats are powered from photovoltaic (PV) cells which convert the sun's energy to electricity, which is then used to power an electric motor or stored by charging a battery. The boats are limited to 480 watts of PV cells and to a maximum weight of lead-acid

batteries. The major restriction on the boat hull design is that it must not exceed 19 feet, 2 inches in length.

The competition events included a 4-hour endurance race to see which boat can go the farthest (Ecole Technologie Supérieur of Montreal took 1st place), a 300-meter sprint race (won by Cedarville), a maneuverability/slalom race (University of Arkansas won), and a technical report submitted before the competition (1st place to The College of New Jersey). Cedarville won this year's competition with a new boat design which proved to be a winning combination/trade-off design for both the slow speed endurance race, the maneuverability events, and the high speed sprint events. The Cedarville boat finished in the top three in every event, and won by the biggest margin of points in the 11 years of the competition!

The 4-hour endurance race is held on a closed course. The boats operate on solar power and the winner is the boat that makes the most laps. The variety of boat designs can be seen as they approach a turn.



The World Champion Cedarville University (Ohio) team with their newly designed boat, which placed in the top three of all major event races.

The top ten finishers were:

- World Champion – Cedarville University
- 2nd University of Arkansas
- 3rd Webb Institute
- 4th Messiah College
- 5th College of New Jersey
- 6th Washington State University
- 7th Ecole Technologie Supérieur
- 8th University of South Carolina
- 9th University of Northern Iowa
- 10th Geneva College

The 2005 Solar Splash will be held in Buffalo, NY on June 22-26, 2005. Information on past competitions, rules, and registration for this next competition can be viewed at www.solarsplash.com. •



HONORS AND AWARDS •

Frank Kreith receives ASME Honorary Membership Award

Longtime Solar Division member Frank Kreith, P.E. is one of four to receive ASME's highest distinction: that of Honorary Membership, which is awarded for distinctive accomplishments in engineering, science, industry, research or public service and those allied pursuits beneficial to the engineering profession. Only 367 members have received this distinction since its creation in 1880. Eighty-six of those are still living. Kreith has received several ASME awards in the past including the ASME Medal in 1998. Kreith is past editor of the JSEE. He continues to be active in the Division, hosting a panel on the Hydrogen Economy at this year's IMECE in Anaheim this November. •

Jane Davidson receives Yellott Award

Professor Davidson's Yellott Lecture addressed the need for innovative solutions to achieving greater market penetration for solar water heating. In the US, water heating accounts for about 18% of the energy use in residential and commercial buildings. Annual shipments of water heaters are 10 million units with a nearly even split between electric and gas. The shocking news is that in the US less than 10,000 solar water heaters are installed each year. Dr. Davidson suggested that through partnerships of solar manufacturers, builders and the research community, it will be possible to drastically improve market penetration through building integrated designs and reduction in first cost. She concluded



Jane Davidson after her Yellott lecture. With (l to r) Carl Bingham, Jeff Morehouse and Mark Thornbloom

her talk with recognition of the contribution of her students and colleagues in the field.

"I have been very fortunate to follow in the footsteps of the pioneers in solar energy, including Professor John I. Yellott. Thank you to the students and colleagues who have been such an important part of my professional success and have made working in the solar energy field such a personal pleasure. In particular, I would like to thank Professor Emeritus George Löf, who got me started." •

State of the SED • continued from page one

Editors as candidate to succeed Jane Davidson. Aldo Steinfeld's extensive research experience at ETH in Switzerland, as well as his editorial experience in JSEE and other Journals makes him a very strong candidate.

Conferencing is another one of our core activities as a division. We hosted several sessions at IMECE in New Orleans in 2002, and held our 2003 ISEC in Hawaii. This was our traditional four-year collaboration with Eastern and Pacific renewable organizations such as the Japan Society of Mechanical Engineer's Heat Transfer Division, Japan Solar Energy Society, Korean Solar Energy Society, as well as several Australian groups coordinated by CSIRO Division of Energy Technology. In addition to the excellent papers and the interaction with participants from the co-located AJTEC 2003, we were able to enjoy the many charms of Hawaii's Kohala Coast, as well as tour the PV installations at Mauna Lani hotel and wind/PV at Parker Ranch. Later that year we hosted two sessions at IMECE in Washington DC, and our Wind Technical Committee (TC) continued its programming at the AIAA Reno conference. In March of this year we began a relationship with Electric Power and the ASME Power conferences, by hosting a panel session on "Solar Thermal for Energy Surety in Industry". While our past programming has targeted solar engineers and solar advocates, the Joint ASME Power/Electric Power meeting allows us to expose a

segment of typically non-renewable engineers to the recent advances and benefits of renewable energy.

While IMECE in DC was our first taste of the ASME WebTool online submittal process, conference chairs Carl Bingham and Agami Reddy jumped in with both feet at ISEC 2004, using the WebTool with great success to provide a robust program of peer-reviewed papers and workshops. This year was a collaborative effort with ASES in Portland Oregon, and once again gave our members and authors interaction with an excellent cross section of renewables researchers, engineers, advocates and enthusiasts.

As with our previous conferencing, ISEC 2004's success was due in no small part to the volunteer efforts of the conference chairs, technical committee chairs, session chairs, reviewers and authors. This is where YOU come in. This is YOUR SOLAR DIVISION. As has been said many times before, the backbone of our Division is made up of the Technical Committees. These committees are where the fun is and you will find one that addresses your interests in renewable energy and energy efficiency. You will find contact information elsewhere in this newsletter and on the website. I encourage you to get involved, whether as an author, a reviewer, session chair, panelist, workshop presenter, or any other role that might suit your interest. This is an excellent way to keep in touch with breaking research in your field of interest and to publicize your work to your peers. For example, I am

interested in providing a forum at our next ISEC in August 2005 on the rapidly emerging field of ocean, wave, and tidal power. This is a broad field that, after many years on the drawing boards, is now finally coming into the light as a viable renewable energy source; we can provide the forum for a studied and juried advancement of the technologies involved. If you are interested in organizing a session or submitting a peer-reviewed paper, please contact me. We are also soliciting papers and panels for ASME Power/Electric Power this coming March in Chicago. We have programming planned for IMECE. In an effort to increase interaction with non-ASME groups to the south, we are working on a collaborative effort with counterpart societies in Mexico, south and central America. We are co-hosting a workshop in Washington DC on Climate Change and funding mechanisms to study it. One of our panels at IMECE will take a critical look at the proposed hydrogen economy. We are looking for experts to help contribute to white papers and responses to Congress on energy matters. There are many ways to get involved. Contact me or any of the names listed at our website, www.asme.org/divisions/solar/.

It has been an honor to serve you on the Executive Committee these past four years. It has been a pleasure working with a great group of people so dedicated to the advancement of renewable energy engineering. I look forward to working with them in the years to come, and I hope that I will get to work with you as well! •

A COMPACT FALLING FILM ABSORBER •

Nitin Goel, D. Yogi Goswami
**Mechanical and Aerospace Engineering
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 32611-6300**

Heat-driven absorption thermodynamic cycles offer the possibility of generating both power and cooling with environmental friendly refrigerants, such as ammonia. A similar cycle was recently proposed by Dr. Yogi Goswami. The cycle is an innovative combination of an ammonia-based Rankine cycle and an ammonia-water absorption refrigeration cycle. The cycle can use source temperatures as low as 70°C, thereby making it a useful power cycle for low-cost solar thermal collectors, geothermal resources and waste heat from existing power plants.

During experimentations on the cycle at the Solar Energy and Energy Conversion Laboratory of University of Florida, it was realized that the absorber is one of the critical components in terms of size, efficiency and cost. An absorber is a combined heat and mass exchanger that absorbs the vapor phase of the absorbate (NH₃) in a liquid absorbent (H₂O) before pumping the mixture to the high-pressure side of the cycle. The vapor flow mechanism divides absorbers into two broad categories, namely, those operating in falling film and bubble absorption modes. The falling film mode over horizontal coolant tubes has been widely utilized in commercial absorption systems and is shown schematically in Figure 1. The design accomplishes a low-pressure drop on the vapor-side, but it inherits low surface contact area and unstable liquid distribution.

In this work, we have proposed a new design of a falling film absorber that could considerably reduce the absorber size. The proposed design is based on the fundamental characteristics of an efficient absorber design: large liquid-vapor interfacial area and good wetting characteristics. The concept utilizes the vertical spacing between the horizontal tubes to form a falling film by a flow guidance medium. Alternatively wrapping a mesh/fabric between the left and right sides of the adjacent tubes as shown in Figure 2 can be utilized to form a liquid film between the horizontal tubes. The mesh/fabric can be made up of a compatible material, such as, aluminum, steel, glass fiber, and nylon. In addition to an increase in surface area, the concept also enhances falling film stability by preventing the coalescence of droplets on horizontal tubes. The combined effect of increased mass transfer area and film stability will improve the absorption flux.

Numerical analysis helps in developing a thorough understanding and an efficient design. The fact that both fluids (ammonia and water) are volatile, and may be present in both liquid and vapor phases, makes the model more complex to analyze. Mass transfer resistance in the liquid phase is often neglected by researchers to simplify their models. However, their models depict the inadequacy of neglecting liquid-phase mass transfer resistance. In this study, a finite difference scheme is developed to numerically investigate the performance of the design. The model is based on the application of continuity and energy balance at each differential segment of the absorbers. It takes into account the mass transfer resist-



Mark Thornbloom with Nitin Goel.
**The recipient of the Graduate Student
 Best Paper award.**

ances in both the liquid and vapor phases, and uses empirical correlations to predict the heat and mass transfer coefficients. It was found that a major fraction of the overall mass transfer resistance lies in the falling film. The proposed design is also analytically compared to the conventional horizontal tube type falling film absorber. The results indicate that the proposed design is more compact and efficient than the conventional falling film absorber. Size reduction of about 36% is possible for the operating conditions considered. On the basis of the numerical analysis, a bench scale absorber is under experimental investigation to verify the performance of the proposed design. A schematic of the proposed design is shown in Figure 3. The improvement in the absorption process will enhance the overall performance of the new thermodynamic cycle. •

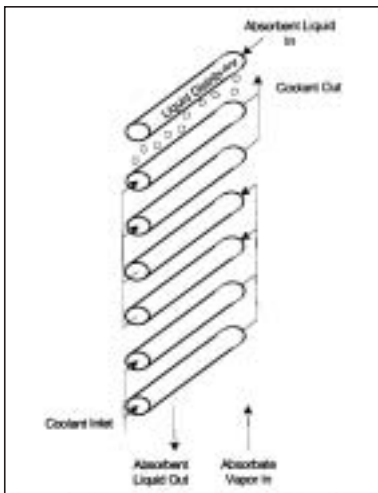


Figure 1. **Conventional horizontal tube type falling film absorber**

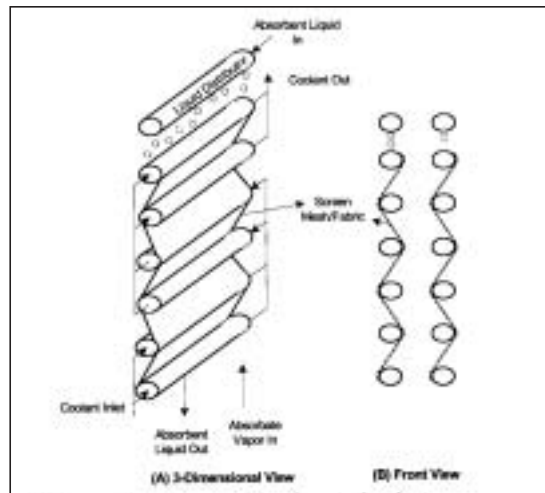


Figure 2. **Proposed horizontal tube type falling film absorber**

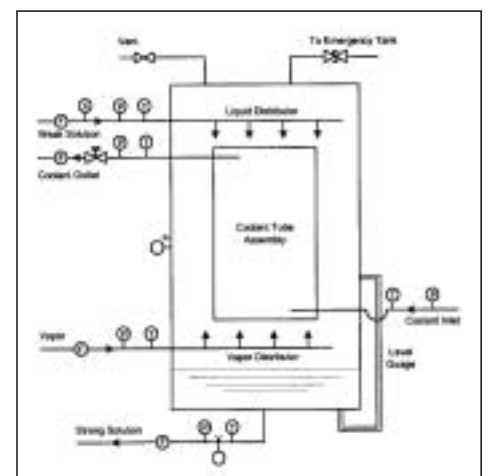


Figure 3. **Schematic of the proposed design**

SOLAR ENERGY DIVISION

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Announcement and Call for Papers

2005 SOLAR WORLD CONGRESS

August 6-12, 2005 • Orlando, Florida

The American Society of Mechanical Engineers' (ASME) Solar Energy Division (SED), American Solar Energy Society (ASES), and the International Solar Energy Society (ISES) are proud to host the 2005 Solar World Congress to be held at the Rosen Centre Hotel in Orlando, Florida from August 6-12, 2005. The 2005 Solar World Congress will include technical papers presented in stand-up presentations, keynote lectures, panel discussions, open forum sessions, and a celebration of the 50th anniversary of ISES.

Papers submitted to ASME will be peer-reviewed and simultaneously considered for publication in the *Journal of Solar Energy Engineering*. Papers are solicited in all areas of renewable and energy efficiency research and development. Topical areas include, but are not limited to:

- Solar thermal systems • Heat pumps • Cogeneration • Solar ponds • Chillers • Energy storage • Ocean energy •
- Solar chemistry & hydrogen • Bioconversion • Photovoltaics • Building energy conservation • Component simulation • Geothermal systems •
- Fuel cells • Efficiency standards • Fundamentals and theory • Bringing water to the world* • The history of solar energy*

* special topics featured at the 2005 Solar World Congress

Abstracts of 500 words or less should be submitted electronically. For more information, please visit the conference website:

www.asmeconferences.org/solar05/

Preliminary Deadlines

Abstracts due – Immediately • Draft manuscript due – 17 December 2004 • Final manuscript due – 1 March 2005

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