

INTERNATIONAL JOURNAL OF ENERGY AND ENVIRONMENT

**Official Journal of the International Energy and
Environment Foundation**

ISSN 2076-2895 (Print) ISSN 2076-2909 (Online)

Volume 6, Issue 1, 2015

© 2015 International Energy and Environment Foundation. All rights reserved

Aims and Scope

The International Journal of Energy and Environment (IJEE) is the official journal of the International Energy and Environment Foundation (IEEF). The journal is a multi-disciplinary, peer-reviewed open access journal, covering all areas of energy and environment related fields that apply to the science and engineering communities. The journal enjoys the full support of the IEEF, who provide funds to cover all costs of publication, including the Article Processing Charges for all authors. Therefore the journal is both free to read and free to publish in for everyone. IJEE aims to promote rapid communication and dialogue among researchers, scientists, and engineers working in the areas of energy and environment. The journal provides a focus for activities concerning the development, assessment and management of energy and environment related programs. The emphasis is placed on original research, both analytical and experimental, which is of permanent interest to engineers and scientists, covering all aspects of energy and environment. It is hoped that this journal will prove to be an important factor in raising the standards of discussion, analyses, and evaluations relating to energy and environment programs. All manuscripts with significant research results in the areas of energy and environment and their application are welcome. *The scope of the journal encompasses the following:*

Energy

- Fuel cells and their applications.
- Hydrogen energy.
- Photovoltaic technology conversion.
- Solar thermal applications.
- Wind energy.
- Hydro energy.
- Biomass and bioenergy.
- Wave and tide energy.
- Geothermal energy.
- Fuel flexibility and alternatives.
- Micro- and nano-energy systems and technologies.
- Hybrid / integrated energy systems.
- Energy conversion, conservation and management.
- Energy efficient buildings.
- Energy generation and energy storage.
- Energy modelling and prediction.
- Energy and sustainable development.
- Energy efficiency and sustainability inherent in heritage places.
- Fluid mechanics and thermodynamics, including CFD, heat transfer and combustion.

Environment

- Energy and environmental impact.
- Thermal, acoustic, visual, air quality building science and human impacts.
- Eco-design of energy-related products.
- Green electric and electronics.
- Solutions for mitigating environmental impacts and achieving low carbon, sustainable built environments.
- Technologies and integrated systems for high performance buildings and cities.
- Tools for the design and decision-making community, including tested computational, economic, educational and policy tools.
- Environment and sustainable development.
- Quality assurance / control.
- Emissions reduction.
- Waste management.
- Evaluation & management of environmental risk and safety.
- Advanced visualization techniques, virtual environments and prototyping.

A note to authors

Submission of articles

Submission of an article implies that the work described has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. The submitting author is responsible for obtaining agreement of all co-authors as well as any sponsors' required consent before submitting a paper. Responsibility for the content of a paper lays on the Authors and not on the Editors or the Publisher. All authors must complete the 'Journal Copyright and License Agreement' before the article can be published. Authors are encouraged to use the IEEF Document Template for preparing manuscripts for submission. The Paper Template represents the author guidelines and desired layout final manuscript of International Journal of Energy and Environment (IJEE). Full instructions can be found on the journal homepage (<http://www.IJEE.IEEFoundation.org>).

Your Submitted Article

- Your article will be peer-reviewed and if accepted will be published very fast.
- Your biography will appear at the end of your article.
- Your article will be published free of charge. The Authors do not pay any kind of publication fees.
- Your article will be published around the world in full color. Free use of color where this enhances the article.
- Your article can be read by potentially millions of readers, which is incomparable to publishing in a traditional subscription journal. All interested readers can read, download, and/or print your article at no cost!
- Your article will obtain more citations.
- Moreover, all articles are indexed by the major indexing media therefore providing the maximum exposure to the articles.

INTERNATIONAL JOURNAL OF ENERGY AND ENVIRONMENT

Official Journal of the International Energy & Environment Foundation

Journal homepage: www.IJEE.IEEFoundation.org



Editor-in-Chief

Maher A.R. Sadiq Al-Baghdadi

President of the International Energy and Environment Foundation (IEEF), Al-Najaf, P.O.Box. 39, Iraq.

Associate Editor

Hashim R. Abdol Hamid

Vice President of the International Energy and Environment Foundation (IEEF), Al-Najaf, P.O.Box. 39, Iraq.

Editorial Advisory Board

Tarek Abdel-Salam

Center of Sustainable Energy, Department of Engineering, East Carolina University, 207 Slay Bldg., Greenville, NC 27858-4353, USA.

Amitava Bandyopadhyay

Department of Chemical Engineering, University of Calcutta, 92, A.P.C.Road, Kolkata 700 009, India.

Angelo Basile

Institute on Membrane Technology of the Italian National Research Council, ITM-CNR, c/o University of Calabria, via P. Bucci, cubo 17/C, 87030 Rende (CS), Italy.

Wojciech Budzianowski

Wroclaw University of Technology, ul. Wybrzeze Wyspianskiego 27, 50-370 Wroclaw, Poland.

Evangelos G. Giakoumis

School of Mechanical Engineering, National Technical University of Athens, 9 Heroon Polytechniou St., Zografou Campus, 15780, Athens, Greece.

Eloy Velasco Gomez

ETS Ingenieros Industriales, Universidad de Valladolid, Paseo del Cauce, no 59, 47011 Valladolid, Spain.

Arunachala Nadar Kannan

Department of Engineering Technology, TECH 156, Arizona State University, 7001 E Williams Field Rd, Mesa, AZ 85212, U.S.A.

T. Lu

School of Mechanical and Electrical Engineering, Beisanhuan East Road, Chaoyang District, Beijing 100029, P.R.China.

A. Mani

Refrigeration and Air-conditioning Laboratory, Department of Mechanical Engineering, Indian Institute of Technology Madras, Chennai 36, Pincode 600 036, India.

Meng Ni

Department of Building and Real Estate, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong.

S-J Park

Department of Chemistry, Inha University, 253 Yonghyun-dong, Nam-gu 402-751, Korea (south).

Andreas Poulikkas

Electricity Authority of Cyprus, 1399 Nicosia, Cyprus.

Md. Mujibur Rahman

Department of Mechanical Engineering, College of Engineering, Universiti Tenaga Nasional, Km 7, Jalan Kajang-Puchong, 43009 Kajang, Selangor, Malaysia.

Julien Ramousse

Polytech'Savoie, Université de Savoie, Campus scientifique, Savoie Technolac, 73376 Le Bourget, du Lac, CEDEX, France.

Teemu Rasanen

*Research Group of Environmental Informatics,
Department of Environmental Sciences, University
of Kuopio, FI-70211 Kuopio, Finland.*

Marc A. Rosen

*University of Ontario Institute of Technology,
Faculty of Engineering and Applied Science, 2000
Simcoe Street North, Oshawa, Ontario, L1H 7K4,
Canada.*

David Michael Rowe

*Cardiff School of Engineering, Queen's Buildings,
Newport Road Cardiff CF24 1XF, U.K.*

Hisham M. Sabir

*Kingston University, Faculty of Engineering, Friars
Avenue, London SW15 3DW, U.K.*

Suresh Babu Sadineni

*Center for Energy Research, Department of
Mechanical Engineering, Howard R. Hughes
College of Engineering, University of Nevada, Las
Vegas (UNLV) 89154-4027, U.S.A.*

Bidyut Baran Saha

*Department of Mechanical Engineering, National
University of Singapore, 9 Engineering Drive 1,
117576, Singapore.*

Vicente Salas

*Department of Electronic Technology, Universidad
Carlos III de Madrid, Avda. de la Universidad, 30,
28911 Leganes, Madrid, Spain.*

Amin U. Sarkar

*School of Business, Alabama A&M University,
Normal (Huntsville), AL 35762, U.S.A.*

Moinuddin Sarker

*Natural State Research, Inc., 37 Brown House Road
(Second Floor), Stamford, CT-06902, USA.*

Joop Schoonman

*Department DelftChemTech: Materials for Energy
Conversion and Storage, Delft University of
Technology, Julianalaan 136, 2628 BL Delft, The
Netherlands.*

Tomonobu Senjyu

*University of the Ryukyus, Faculty of Engineering, 1
Senbaru Nishihara-cho Nakagami Okinawa 903-
0213, Japan.*

Jose Ramon Serrano

*Universidad Politécnic de Valencia, CMT-Motores
Térmicos, Camino de Vera s/n, 46022 Valencia,
Spain.*

Haroun A.K. Shahad

*Department of Mechanical engineering, University
of Babylon, Babylon, Iraq.*

Rajnish N. Sharma

*Department of Mechanical Engineering, University
of Auckland, Private Bag 92019, Auckland 1142,
New Zealand.*

S.A. Sherif

*HVAC Laboratory, Department of Mechanical and
Aerospace Engineering, University of Florida, 232
MAE Bldg. B, Gainesville, Florida 32611-6300,
U.S.A.*

Shailendra Kumar Shukla

*Department of Mechanical Engineering, Institute of
Technology, B.H.U., Varanasi-221005, India.*

Rayan Slim

*Center for Energy and Processes, Ecole des Mines
de Paris, 104 Bobillot Street, 75013 Paris, France.*

Laizhou Song

*Department of Environmental and Chemical
Engineering, Yanshan University, Qinhuangdao
City, Hebei Province, P.R.China.*

Adnan Sozen

*Department of Mechanical Education, Gazi
University, Technical Education Faculty 06500
Teknikokullar, Ankara Turkey.*

Roland Span

*Lehrstuhl für Thermodynamik, Ruhr-University
Bochum, D-44780 Bochum, Germany.*

Anurag K. Srivastava

*Electrical and Computer Engineering, Mississippi
State University, 216 Simrall Hall, Hardy Road,
Mississippi State, MS 39762, U.S.A.*

Rosetta Steeneveldt

*Research Centre Trondheim, StatoilHydro, Arkitekt
Ebbells vei 10, N 7005 Trondheim, Norway.*

Athina Stegou-Sagia

*School of Mechanical Engineering, Department of
Thermal Engineering, National Technical
University of Athens, 9 Iroon Polytechniou Str.
Zografou 157 80, Athens, Greece.*

Peter Stigson

*School of Sustainable Development of Society and
Technology, Mälardalen University, 721 23
Västerås, Sweden.*

Anna Stoppato

*Department of Mechanical Engineering, University
of Padova, via Venezia, 1-35131 Padova, Italy.*

Michael Stoukides

Department of Chemical Engineering, Aristotle University of Thessaloniki, Thessaloniki 54124, Greece.

Jian-Feng Sun

College of Food Science and Technology, Agricultural University of Hebei, Baoding City, Hebei Province, 071000 P.R.China.

Stanislaw Szwaja

Department of Engineering Mechanics, Michigan Technological University, 1400 Townsend Drive, Houghton, MI, 49931, U.S.A.

David S-K. Ting

Mechanical, Automotive & Materials Engineering, University of Windsor, Windsor, Ontario, N9B 3P4, Canada.

G. N. Tiwari

Centre for Energy Studies, Indian Institute of Technology Delhi, Hauz Khas, New Delhi - 110 016, India.

Bor-Jang Tsai

Department of Mechanical Engineering, Chung Hua University, No. 707, Sec. 2, Wu Fu Rd., Hsinchu 300, Taiwan.

Athanasios Tsolakis

School of Mechanical Engineering, University of Birmingham, Edgbaston, Birmingham, B15 2TT, U.K.

Per Tunestal

Department of Energy Sciences, Lund University, SE-221 00 Lund, Sweden.

Aynur Ucar

Department of Mechanical Engineering, Firat University, Elazig, Turkey.

Despina Vamvuka

Department of Mineral Resources Engineering, Technical University of Crete, University Campus, Hania 73100, Crete, Greece.

Virendra Kumar Vijay

Centre for Rural Development and Technology, Indian Institute of Technology Delhi, Hauz Khas, New Delhi 110016, India.

Shengwei Wang

Department of Building Services Engineering, The Hong Kong Polytechnic University, Hong Kong.

Yi-Ming Wei

Center for Energy and Environmental Policy Research (CEEP), Beijing Institute of Technology, No.5 South Zhongguancun Street, Haidian District, Beijing 100081, P.R.China.

Samantha Wijewardane

Laboratory for Advanced Materials, Science and Technology (LAMSAT), Department of Physics, University of South Florida, 4202 E. Fowler Ave., Tampa, FL 33620, USA.

Gwomei Wu

Chang Gung University, 259 Wen Hua 1st Road, Kweisan, Taoyuan 333, Taiwan.

Contents

Analysis of transport phenomena and electrochemical reactions in a micro PEM fuel cell with nature inspired flow field design.	1-16
<i>Maheer A.R. Sadiq Al-Baghdadi</i>	
Wind energy potential of Marmara region in Turkey.	17-26
<i>Oktay Arikan, Evren Isen, Cagri Kocaman, Bedri Kekezoglu</i>	
The spatial distribution of dust sources in Iraq by using satellite images.	27-36
<i>Kamal H.Lateef, Azhaar K.Mishaal, Ahmed M.Abud</i>	
Decomposition analysis of industry sector CO₂ emissions from fossil fuel combustion in Kazakhstan.	37-46
<i>Almaz Akhmetov</i>	
Costing energy efficiency improvements in buildings Case study: Braşov, Romania.	47-60
<i>Elena Eftimie</i>	
Exergoeconomic optimization of an irreversible regenerated air refrigerator with constant-temperature heat reservoirs.	61-72
<i>Yi Zhang, Lingeng Chen, Guozhong Chai</i>	
Performance analysis of an endoreversible rectangular cycle with heat transfer loss and variable specific heats of working fluid.	73-80
<i>Chao Wang, Lingen Chen, Yanlin Ge, Fengrui Sun</i>	
Natural convection in a room with two opposite heated vertical walls.	81-86
<i>Ameer Saad, Abdul Jabbar N. Khalifa</i>	
Analytical performance investigation of parabolic trough solar collector with computed optimum air gap.	87-96
<i>Devander Kumar, Sudhir Kumar</i>	
Najaf, new Saffron homeland.	97-106
<i>Hashim R. Abdol Hamid</i>	

Announcements - IEEF Release

BOOK: CFD Applications in Energy and Environment Sectors: Volume 1.

Editors: Maher A.R. Sadiq Al-Baghdadi and Hashim R. Abdol Hamid (ISBN 13: 978-1-46623-065-1)

BOOK: Engineering Applications of Computational Fluid Dynamics: Volume 1.

Editor: Maher A.R. Sadiq Al-Baghdadi (ISBN 13: 978-1-46623-106-1)

BOOK: CFD Modeling in Development of Renewable Energy Applications.

Editor: Maher A.R. Sadiq Al-Baghdadi (ISBN 13: 978-1-46623-131-3)

BOOK: Engineering Applications of Computational Fluid Dynamics: Volume 2.

Editor: Maher A.R. Sadiq Al-Baghdadi (ISBN 13: 978-1-47832-935-0)

BOOK: PEM Fuel Cells - Fundamentals, Modeling, and Applications.

Author: Maher A.R. Sadiq Al-Baghdadi (ISBN 13: 978-1-48197-823-1)

BOOK: Alternative Fuels Research Progress.

Editor: Maher A.R. Sadiq Al-Baghdadi (ISBN 13: 978-1-48405-771-1)

BOOK: Computational Fluid Dynamics Applications in Green Design.

Editor: Maher A.R. Sadiq Al-Baghdadi (ISBN 13: 978-1-49487-575-6)

BOOK: Stress Redistribution in Composite Materials.

Author: Luay S. Alansari (ISBN 13: 978-1-49730-742-1)