EVOLVING ENERGY

The IEF International Energy Congress

17–18 September 2012
Sydney Convention and Exhibition Centre
Sydney, Australia

International Energy Foundation

CONGRESS HANDBOOK

RMIT UNIVERSITY

Platinum Sponsor

Curtin University

Silver Sponsor

CONTENTS

The International Energy Foundation is a non-profit body consisting of scientists, researchers, engineers and industrialists from around the globe working together. The mission is to facilitate the Research and Development, Production, transfer of Technology in all areas of energy with special emphasis on helping developing countries. The aim is to establish better ways to produce, transmit and conserve energy with respect to the technical, economic and human dimensional elements including global climate change and sustainable development. The foundation deals with all forms of energy and operates across 175 Countries. **Further details may be found at http://www.ief-energy.org**

MESSAGE FROM CHAIRPERSON

INTERNATIONAL ENERGY FOUNDATION
INTERNATIONAL ENERGY CONGRESS

I am pleased to welcome to vivacious Sydney the delegates and all participants of the Evolving Energy-International Energy Foundation International Energy Congress (IEF-IEC2012). The proposition of this congress is that the energy issue should never be seen in the context of Saints and Sinners; hence the theme: Human Ingenuity Making the Benefits of All Things Energy Possible.

IEF-IEC2012 seeks to bring together, from all over the world, industry, academia, research institutions, energy policy makers and community leaders to deliberate over one of the most urgent problems today- the generation and utilization of energy from all energy sources with minimum adverse impact on the environment. IEF-IEC2012 will provide a forum for discussions pertaining to novel ways to improve efficient use of conventional energy sources. It will provide the opportunity for discussions about the development and viability of the gamut of emerging alternative and renewable energy resources.

It is with great pleasure that I welcome the future leaders of our society who will be presenting their views on the issues of energy security and climate change in the Youth Energy Forum, which is an important part of this congress.

You are invited to participate in this congress, with eminent presenters who are listed in this document, to examine the issues which underpin energy security and measures to mitigate environmental damage.

I would like to take this opportunity to thank companies, academic and Government Institutions, as well as all the other organizations which have contributed in diverse ways to provide generous sponsorship for this congress.

Professor Sylvester Abanteriba
Convenor and Chair
Chair, Board of Directors, IEF

GENERAL INFORMATION

REGISTRATION DESK

The Registration Desk will be located in the bayside foyer Level 2 of the Convention & Exhibition Centre and will be open at the following times:
Monday 17th September 8:00am – 5:30pm
Tuesday 18th September 8:00am – 5:00pm

CONGRESS NAME BADGES

All delegates will be provided with a name badge, please wear your name badge at all times as it will be your entry into all Sessions and all Social Functions.

DISCLAIMER

The Evolving Energy 2012 Congress reserves the right to amend or alter any advertised details relating to dates, program and speakers if necessary, without notice, as a result of circumstances beyond their control. All attempts have been made to keep any changes to an absolute minimum.

ENTRY TO SOCIAL EVENTS

Entry to social events will not require a ticket, attendees and additional guests will appear on a guest list.

MOBILE PHONES

As a courtesy to other delegates, please ensure that all mobile phones are turned off or are in a silent mode during all sessions and social functions.

SPEAKERS

Speakers will be asked to bring their presentations with them on a USB stick, then load their presentations onto the computer in the corresponding theatre. This must be done at least by the break prior to your presenting time – this may mean the day before your presentation.
There will be dedicated speakers assistants to provide help uploading your file. All speakers are responsible for ensuring their presentation is uploaded and ready for their session. Please see the staff at the Registration Desk for further information.

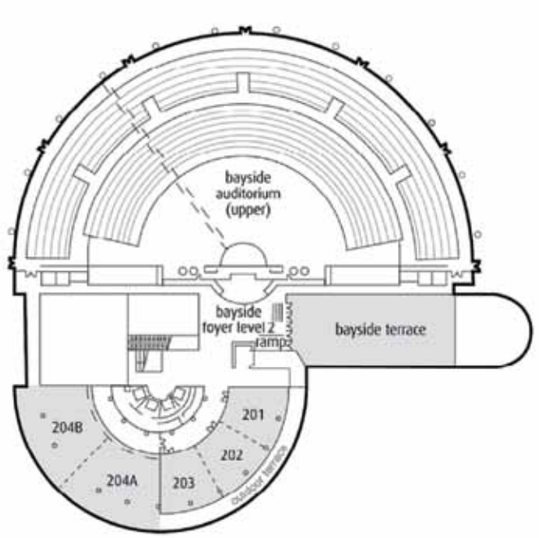
SPECIAL DIETS

All catering venues have been advised of any special diet preferences indicated by delegates.
Please identify yourself to venue staff as they come to serve you and they will be pleased to provide you with all pre-ordered food. For day catering, food will be served in the bayside foyer level 2.

WEBSITE

Updated Congress information can be found at **http://www.ief-congress.org/**

CONVENTION CENTRE BAYSIDE | **LEVEL 2**



CONGRESS PROGRAM DAY 1 MONDAY 17 SEPTEMBER 2012

Time	Session Type	Session No.	Session Description
09:00-09:15	Welcome	1	**Congress Official Welcome** Professor Sylvester Abanteriba Chair, Board of Directors, International Energy Foundation RMIT University, Australia Venue: Bayside 204A Session Chair: Associate Professor Firoz Alam, RMIT University
09:15-09:30		2	**Official Congress Opening** Professor Aleksandar Subic Dean of Engineering, SEH College, RMIT University Venue: Bayside 204A Session Chair: Associate Professor N. A. Ahmed, Head of Aerospace Engineering, UNSW
09:30-10:30	Concurrent	3	**PLENARY 1** **Development of Nano-materials for Energy Applications at Institute for Superconducting and Electronic Materials (ISEM)** Professor Shi Xue Dou, Professorial Fellow and Director, Institute of Super Conducting Materials University of Wollongong, Australia Venue: Bayside 204 Session Chair: Professor Xinghuo Yu Head, Platform Technologies Research Institute, RMIT University
10:30-11:00			*Morning Tea*
10:30–11:00			*Preparation for Youth Energy Forum*
11:00-12:00		4	**Youth Energy Forum** Venue: Bayside 204B Co-Chairs: Robert Carrese; Paul Noonan Opening Address: Professor Thomas Faunce, Australian National University
12:00-13:00			*Lunch*
13:00-14:00	Plenary	5	**PLENARY 2** **Energy Demand and Reliability of Supply** Robert Pritchard ResourcesLaw International, Australia Venue: Bayside 204A Session Chair: Dr. Mirek Piechowski Meinhardt Australia Pty Ltd, Australia
14:00-16:00	Concurrent	6	**Renewable Energies** **Solar Energy** Venue: Bayside 201 Session Chair: Professor Abd Halim Shamsuddin Centre for Renewable Energy, Universiti TenaGa Nasional, Malaysia]
14:00–14:30			Invited Presentation **Charge Photo-generation and Recombination in Polymer Solar Cells: A Scientific Roadmap Towards 15% Power Conversion Efficiency** Dr. Attila Mozer ARC Centre of Excellence for Electromaterials Science, Intelligent Polymer Research Institute University of Wollongong, Australia

Time	Session Type	Session No.	Session Description
14:30-14:50			**A Novel Solar-assisted Air-conditioner System for Energy Savings with Performance Enhancement** Q.P. Ha, V. Vakiloroaya School of Electrical and Mechatronics Systems, University of Technology, Australia
14:50-15:10			**Small Scale Power Generation using Low Grade Heat from Solar Pond** Baljit Singh[a,b,], J. Gomes[a], Lippong Tan[a], Abhijit Date[a], A. Akbarzadeh[a]. [a]School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia [b]Faculty of Mechanical Engineering, Universiti Teknologi MARA (UiTM), Malaysia
15:10-15:30			**Effect of the Ratio of Specific Heats on a Small Scale Solar Brayton Cycle** H. Riazi , N.A. Ahmed School of Mechanical and Manufacturing Engineering, University of New South Wales, Australia
15:30-15:50			**Design of a Dynamic Control System for Standalone Solar-hydrogen Power Generation** Xin Xu Dou, John Andrews School of Aerospace Mechanical and Manufacturing Engineering, RMIT University, Australia
14:00-16:00	Concurrent	7	**Renewable Energies** **Wind Energy** Venue: Bayside 202 Session Chair: Dr Buyung Kosasih, School of Mechanical, Materials and Mechantronics Engineering, University of Wollongong, Australia
14:00 -14:20			**Improving Safety and Performance of Small-scale Vertical Axis Wind Turbines** Joshua Yen, Noor Ahmed Aerospace Engineering, School of Mechanical and Manufacturing Engineering, University of New South Wales, Australia
14:20-14:40			**Review of Wind Energy Utilisation in South Asia** Iftekhar Khan[a] , Harun Chowdhury[a], Roesfiansjah Rasjidin[a], Firoz Alam[a], Tazul Islam[b], and Sadrul Islam[c] [a]School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia [b]Department of Mechanical Engineering, Chittagong University of Engineering and Technology, Bangladesh [c]Department of Mechanical and Chemical Engineering, Islamic University of Technology, Bangladesh
14:40-15:00			**Wind Turbine Performance Improvements Using Active Flow Control Techniques** S. Shun; N.A. Ahmed University of New South Wales, Australia
15:00-15:20			**Development of a Wind Tunnel Test Facility to Simulate the Effect of Rain on Roof Ventilation Systems and Environmental Measuring Devices** T. G. Flynn[a], G. Behfarshad[b] and N. A. Ahmed[c] [a]Aerodynamics Laboratory, School of Mechanical and Manufacturing Engineering, University of New South Wales, Australia [b]Department of Mechanical Engineering, University of British Columbia, Canada [c]School of Mechanical and Manufacturing Engineering, University of New South Wales, Australia

15:20-15:40			**Status of Power Generation by Domestic Scale Wind Turbines in Australia** Firoz Alam[a], Abdulkadir Ali[a], Iftekhar Khan[a], Saleh Mobin[b] [a]School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University [b] Department of Higher Education Primary Industries, Northern Melbourne Institute of TAFE (NMIT)
15:40-16:00			**Experimental and Computational Study of a Micro Vertical Axis Wind Turbine** Abdulkadir Ali[a], Steve Golde[b], Firoz Alam[a], and Hazim Moria[a] [a]School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University [b]Wind Energy Technology Pty Ltd, Australia
14:00-16:00	Concurrent	8	**Alternative Energies** Venue: 204B Session Chair: Dr. Robert Carrese
14:00-14:30			Invited Presentation **Homogeneous Catalysts with a Mechanical ("Machine-like") Action. Catalytic Water Splitting Inspired by Photosynthesis** Professor Gehard Swiegers Intelligent Polymer Research Centre, ARC Centre of Excellence for Electromaterial Science University of Wollongong, Australia
14:30-15:00			Invited Presentation **Heterotrophic Microalgae for Biofuel Production** L. Rye[a], K. Lee Chang[b], D. Batten[a] [a]Energy Transformed Flagship, CSIRO, Australia [b]Marine and Atmospheric Research, CSIRO, Australia
15:00-15:20			**A Novel Continuous Extractive Reactor for Biodiesel Production Using Lipolytic Engine** Dean M. Chesterfield[a], Peter L. Rogers[b], Essam O. Al-Zani[a] and Adesoji A. Adesina[a] [a]Reactor Engineering and Technology Group, School of Chemical Engineering, University of New South Wales, Australia bSchool of Biotechnology and Biomolecular Sciences, University of New South Wales, Australia
15:20-15:40			**Manufacture, Qualification and Approval of New Aviation Turbine Fuels and Additives** U. Yildirim[a], S.Abanteriba[b] [a]Joint Fuels and Lubricants Agency, Royal Australian Air Force [b]School of Engineering, RMIT University, Melbourne, Australia
15:40-16:00			**Biofuel from Algae- a Review** Firoz Alam[a], Abhijit Date[a], Saleh Mobin[b] and Sadiqul Awal[b] [a]School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia [b]Depatment of Higher Education Primary Industries, Northern Melbourne Institute of TAFE (NMIT), Australia
14:00-16:00	Concurrent	9	**Sustainable Energy Policy** Venue: Bayside 204A Session Chair: Professor Thomas Faunce Australian National University

Time	Session Type	Session No.	Session Description
14:00-14:40			Keynote Presentation **Sustainable Mobility Based on New Energy Design Paradigms** Professor Aleksandar Subic School of Aerospace, Mechanical and Manufacturing Engineering RMIT University, Australia Bayside 204B
14:40-15:00			**Where Does Hydrogen Fit in a Sustainable Energy Economy?** John Andrews, Bahman Shabani RMIT University, Australia
15:00-15:20			**Prospects and problems of increasing electricity production from mid-size renewable energy generation on the South-West Interconnected System (SWIS) in WA** Delphine de Babline[a], Tania Urmee[a], Jamie Ally[b] [a]School of Engineering and Energy, Murdoch University, Australia [b]General Manager, EMC Limited, Australia
15:20-15:40			**An Energy Saving Approach in the Manufacture of Carbonated Soft Drink Bottles** Fugen Daver and Bilal Demirel School of Aerospace, Mechanical & Manufacturing Engineering, RMIT University, Australia
15:40-16:00			**Vehicle Concept Modeling: A New Technology for Structures Weight Reduction** Pooja Doke, Mohammad Fard, Reza Jazar School of Aerospace, Mechanical and Manufacturing Engineering RMIT University, Australia
16:00-16:20			*Afternoon Tea*
16:20-17:20		10	PLENARY 3 **Smart Grids: A Bird's Eye View** Professor Xinghuo Yu Head of Platform Technologies Institute, RMIT University, Australia Venue: 204 A Session Chair: Associate Professor Vladimir Strezov, Maquarie University, Australia
19:00-22:00			*Banquette*

CONGRESS PROGRAM DAY 2 TUESDAY 18 SEPTEMBER 2012

Time	Session type	Session No.	Session Description
09:00-10:00	Plenary	11	PLENARY 4 **Towards a Global Solar Fuels Project- Artificial Photosynthesis and the Transition from Anthropocene to Sustainocene** Professor Thomas Faunce College of Medicine, Biology and Environment and College of Law Australian National University, Australia Venue: Bayside 204A Chair: Professor Gerhard Swiegers, University of Wollongong, Australia
10:00-10:30			*Morning Tea*

Time	Session type	Session No.	Session Description
10:30-12:30	Concurrent	12	**Power Systems Modelling, Optimisation and Management** Venue: Bayside 204A Session Chair: Dr. Richard Corkish University of New South Wales, Australia
10:30-11:00			Invited Presentation **Sustainability Challenges of Electricity Generation Technologies** Vladimir Strezov, Annette Evans and Tim Evans Graduate School of the Environment, Faculty of Science, Macquarie University, Sydney, Australia
11:00-11:20			**Fuzzy Logic Based Environmental Indicator for Sustainability Assessment of Renewable Energy System using Life Cycle Assessment** Gang Liu, A. Baniyounes, M.G. Rasul, M.T.O. Amanullah and M.M.K. Khan Power & Energy Research Group, Central Queensland University, Australia

Time	Session Type	Session No.	Session Description
11:20-11:40			**Hybrid Energy System for St. Martin Island, Bangladesh: An Optimized Model** A.K.M. Sadrul Islam[a], Md. Mustafizur Rahman[a], Md.Alam H. Mondal[b], Firoz Alam[c] [a]Dept. of Mechanical and Chemical Engineering, Islamic University of Technology, Bangladesh [b]Energy Institute, AERE, Bangladesh Atomic Energy Commission, Bangladesh [c]School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia
11:40-12:00			**Design and Modeling of a Greenhouse for a Remote Region in Nepal** Seona Candy[a], Graham Moore[a], Peter Freere[b] [a]Department of Infrastructure Engineering, The University of Melbourne, Australia [b]World Vision Australia, Burwood Victoria, Australia
12:00-12:30			**Numerical Evaluation of Wind Driven Ventilator for Enhanced Indoor Air Quality** Jason Lien, Noor Ahmed School of Mechanical and Manufacturing Engineering, University of New South Wales, Australia
10:30-12:30	Concurrent	13	**Emissions Management** Venue: 202 Session Chair: Associate Professor N. Ahmed, University of New South Wales, Australia
10:30-11:10			Keynote Presentation **Development of Renewable Energy in Malaysia – Strategic Initiatives for Carbon Reduction in the Power Generation Sector** Abd Halim Shamsuddin Centre for Renewable Energy, Universiti Tenaga Nasional, Malaysia
11:10-11:30			**Control and Management of Particulate Emissions using Improved Reverse Pulse-jet Cleaning Systems** Nicholas Findanis[a] and Noor E. Ahmed[b] [a]Tyco Environmental Systems, Australia [b]The University of New South Wales, Australia
11:30-11:50			**Integration of Carbonation Process with Coal Fired Power Plant to Reduce CO2 Emissions** S. Moazzem, M.G. Rasul and M.M.K. Khan Power and Energy Engineering Research Group, School of Engineering and Built Environment' Central Queensland University, Australia

Time	Session Type	Session No.	Session Description
11:50-12:30			Keynote Presentation **Recent Advances in Low Emission Coal Technologies** Professor Behdad Moghtaderi Priority Research Centre for Energy, Chemical Engineering, Faculty of Engineering & Built Environment, University of Newcastle, Australia
10:30-12:30	Concurrent	14	**Environmental Friendly and Energy Efficient Systems in Buildings** Venue: 204B Chair: Professor Hui Tong Chua, Taiyuan University of Technology, China, University of Western Australia
10:30-11:10			Keynote Presentation **Renewable and Energy Efficiency Infrastructure for Sustainable Cities** Mirek Piechowski Meinhardt Australia Pty Ltd, Australia
11:10-11:30			**A New Zone Temperature Predictive Modelling for Energy Saving in Buildings** Hao Huang , Lei Chen, Morteza Mohammadzaheri, Eric Hu School of Mechanical Engineering, University of Adelaide, Australia
11:30-11:50			**Application of Flow Control Techniques for Indoor Ventilation** Chaofan Wu, Noor-E-Alam Ahmed School of Mechanical and Manufacturing Engineering, Australia
11:50-12:10			**Optimising Louver Location to Improve Indoor Thermal Comfort Based on Natural Ventilation** N.A. Ahmed, K. Wongpanyathaworn School of Mechanical Engineering, University of New South Wales, Australia
12:10-12:30			**Experimental Study of Shrouded Micro Wind- Turbine** Buyung Kosasih, Andrea Tondelli School of Mechanical, Materials and Mechantronics Engineering, University of Wollongong, Australia
12:30-13:30			*Lunch*
13:30-15:30	Concurrent	15	**Energy Conservation, Demand and Efficiency** Venue: 204B Session Chair: Professor Behdad Moghtaderi, University of New castle
13:30-13:50			**Is There a Role for Biofuels in Promoting Energy Self-sufficiency and Security? An Analysis of Biofuel Policy in Thailand** John Asafu-Adjaye[a] , Suthin Wianwiwat[b] [a]School of Economics, The University of Queensland, Australia [b]Faculty of Management Science, Khon Kaen University, Thailand
13:50-14:10			**Possible optimization of energy balance in automotive sector by the use of carbon composite structures** Martin Roehrig, Alexendar Engels Composites Technology Centre GmbH A company of Airbus Operations GmbH, Germany
14:10-14:30			**Consequence Analysis of Scarcity Using Impacts from Resource Substitution** Shaun Rimos, Andrew F.A. Hoadley, David J. Brennan Department of Chemical Engineering, Monash University, Australia
14:30-14:50			**Impact of Vehicle Add-ons on Energy Consumption and Greenhouse Gas Emissions** Harun Chowdhury, Firoz Alam, Iftekhar Khan, Simon Watkins School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia
14:50-15:10			*Afternoon Tea*

Time	Session Type	Session No.	Session Description
15:10-15:30			**A System Dynamics Conceptual Model on Retail Electricity Supply and Demand System to Minimize Retailer's Cost in Eastern Australia** Roesfiansjah Rasjidin, Arun Kumar, Firoz Alam, Iftekhar Khan, Shougi Abosuliman School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia
15:30-15:50			**Thermal Performance Modelling of Residential House Wall Systems** Fayez Aldawi[a,b], Firoz Alam[a], Hazim Moria[a,b], Mohammed Alghamdi[b] [a]RMIT University,School of Aerospace, Mechanical and Manufacturing, Australia [b]Yunbu Industrial College, Mechanical Engineering Department, Kingdom of Saudi Arabia
13:30-15:50	Concurrent	16	**Novel Efficient Propulsion Techniques** Venue: 202 Session Chair: Associate Professor Firoz Alam, RMIT University
13:30-14:10			Keynote Presentation **Bio-inspired Revolution in Emerging Advanced Renewable Energy and Unsteady Propulsion Concepts** Javid Bayandor Crashworthiness for Aerospace Structures and Hybrids (CRASH) Lab Virginia Tech, USA
14:10-14:30			**Experimental Investigation of Employing Asymmetrical Electrodes in Propulsion of Vehicles** George Matsoukas, N.A.Ahmed School of Mechanical and Manufacturing Engineering, University of New South Wales, Australia
14:50-15:10			**Heat Dissipation Using Minimum Counter Flow Jet Ejection during Spacecraft Re-entry** Y. Zheng[a], N.A. Ahmed[a] and W. Zhang[b] [a]School of Mechanical and Manufacturing Engineering, University of New South Wales, Australia [b]College of Aerospace and Materials Engineering, National University of Defence Technology, China
14:50-15:10			*Afternoon tea*
15:10-15:30			**Experimental Investigation of H_2 Generator and PEM Fuel Cell as a Remote Area Back-up Power** Kannan J. Krishnan; Aktar Kalam and Aladin Zayegh Victoria University, Australia
15:30-15:50			**Renewable Energy Education at UNSW** Richard Corkish, Stephen Bremner, Anna Bruce, Gavin Conibeer, Hanzheng Duo, Evatt Hawkes, Bany Jaya, Merlinde Kay, Alison Lennon, Ivan Perez-Wurfl, Alistair Sproul, Ted Spooner, Santosh Shrestha, Geoff Stapleton, Ashraf Uddin, Muriel Watt, Darcy Wentworth School of Photovoltaic & Renewable Energy Engineering, University of New South Wales, Australia
13:30-15:50	Concurrent	17	**New Technologies for Traditional Energies** Venue: 204A Session Chair: Dr. Fugen Daver, RMIT University
13:30-14:10			Keynote Presentation **Low Grade Heat Driven Multi-effect Distillation Desalination Technology** Hui Tong Chua School of Environmental Science and Engineering, Taiyuan, University of Technology, China School of Mechanical and Chemical Engineering, the University of Western Australia, Australia

Time	Session Type	Session No.	Session Description
14:10-14:30			**Examining the Potential of Split Reaction Water Turbine for Ultra-low Head Hydro Resources** Abhijit Date; Ashwin Date; Aliakbar Akbarzadeh; Firoz Alam Energy Conservation and Renewable Energy Group, School of Aerospace Mechancal & Manufacturing Engineering, RMIT University, Australia
14:30-14:50			**Experimental Analysis of Two-phase Flow Nozzle for Desalination and Power Generation System** Sara Vahaji, Abhijit Date, Aliakbar Akbarzadeh Energy Conservation and Renewable Energy Group, School of Aerospace, Mechanical and Manufacturing Engineering, Bundoora Campus RMIT University
14:50-15:10			*Afternoon Tea*
15:10-15:30			**Expander Modelling in Binary Cycle Utilizing Geothermal Resources for Generating Green Energy in Victoria, Australia** M.Oreijah , As. Date, A. Date, M. Bryson, A. Akbarzadeh School of Aerospace Mechanical and Manufacturing Engineering, RMIT University, Australia
15:30-15:50			**Hydro Power Systems in Remote Rural Electrification: a Case Study in the Bawan Valley, Borneo** Sari Murni[a], Jonathan Whale[a], Tania Urmee[a], John Davis[a], David Harries[b] [a]Murdoch University, Australia [b]The University of Western Australia, Australia
15:30-15:50			**Poster Presentation** **Optimisation of Dual-Purpose Solar Ammonia-Water Absorption Heat Pump** Yuebin Zhao[a], Robert Taylor[a], Alistair Sproul[b], Françoise Burgun[c], Andrew Tanner[d] [a]School of Mechanical and Manufacturing Engineering [b]School of Photovoltaic and Renewable Energy Engineering University of New South Wales, Sydney, NSW 2052, Australia [c]CEA INES RDI - French National Institute for Solar Energy, Le Bourget-du-Lac, Rhône-Alpes, France [d]Chromasun Pty Ltd, San Jose, CA, USA
16:00-17:00	Plenary	18	**PLENARY 5** **New Horizons of Applications of the 21st Century Aerodynamic Concepts from Aerospace to Power Generation and Utilization** Venue: 204A Chair: Professor Aktar Kalam Victoria University, Australia
17:00-17.15	Closing	19	**Closing address** Sylvester Abanteriba Chair, Board of Directors, IEF RMIT University Venue: 204A Chair: Dr. Fugen Daver, RMIT University, Australia

THE INTERNATIONAL ENERGY CONGRESS 17-18 SEPTEMBER 2012 EVOLVINGENERGY

PLENARY SPEAKERS

Professor Shi Xue DOU

S.X. Dou is an Australian Professorial Fellow and Director of the Institute for Superconducting and Electronic Materials (ISEM) in University of Wollongong. He received his PhD in chemistry in 1984 at Dalhousie University, Canada. He was elected as a Fellow of the Australian Academy of Technological Science and Engineering in 1994. He was awarded a DSc by the University of New South Wales in 1998 and awarded three consecutive Australian Professorial Fellowship by Australian Research Council in 1993, 2002 and 2007. Australian Government awarded him the Centenary Medal for his achievements in materials science and engineering in 2003. He received Vice-Chancellor Excellent Senior Researcher Award in 2008. His publications have attracted more than 10900 citations with h index of 46. He has supervised or co-supervised 60 PhD graduates. He is specialised in energy and superconductor materials including high performance lithium ion battery for electric vehicles and patented magnesium diboride superconductor wires for applications in magnetic resonance imaging and electric power system such as fault current limiter for smart grid and electric motor for wind turbine.

Professor Xinghuo Yu

Professor Xinghuo Yu is the Director of the Platform Technologies Research Institute at RMIT University, Melbourne, Australia, which is one of the four flagship research institutes recently established to drive RMIT's research agenda. Professor Yu's research interests include control systems, complex and intelligent systems and industrial applications in manufacturing and energy Systems. He has published over 380 refereed papers in technical journals, books and conference proceedings. Professor Yu is Vice-President (Planning and Development) of IEEE Industrial Electronics Society, and an IEEE Distinguished Lecturer. He is a Fellow of the IEEE, a Fellow of the Institution of Engineers Australia (IEAust) and a Fellow of the Australian Computer Society (ACS). Professor Yu is serving as an Associate Editor of IEEE Transactions on Circuits and Systems Part I, IEEE Transactions on Industrial Informatics, IEEE Transactions on Industrial Electronics and several other scholarly journals. He received an award under the Thousand Talents Program of the Chinese Government in 2010, a Chang Jiang Scholar (Chair Professor) Award from the Ministry of Education of China in 2009, the 1995 Central Queensland University Vice Chancellor's Award for Research, and was made Emeritus Professor of Central Queensland University in 2002 for his long term contributions. He together with his co-workers have also received several best paper awards in international conferences. Professor Yu is Chair of the Technical Committee on Smart Grids of IEEE Industrial Electronics Society. He is currently the General Chair of the 37th Annual Conference of IEEE Industrial Electronics Society held in Melbourne, Australia, 7-10 November 2011.

Robert Pritchard

Robert Pritchard is managing director of ResourcesLaw International, a Sydney-based law and consulting firm specialising in the energy industry. Robert has been intensively involved in policy, privatisation and regulatory matters, as well as in development projects relating to oil, gas, coal, uranium, renewable energy, alumina, aluminium, independent power, gas pipelines, electricity transmission and energy technologies, including coal liquefaction and coal refining. Robert has 40 years' experience as a legal adviser and independent consultant, representing government and private sector clients in all facets of the upstream and downstream sectors of the energy industry and advising on many joint ventures and strategic alliances. Robert is an adviser to many government agencies, utilities, multinational corporations and other private sector investors. His clients have included, at various times BP, the Central Electricity Generating Board and National Coal Board of the UK, Kobe Steel, Japan Alumina Associates and the New Energy Development and Industrial Technology Organisation of Japan. Since 2000 he has been a regular consultant to the Asia-Pacific Economic Cooperation (APEC) Energy Working Group on electricity industry reform, cross-border gas and power trade, gas pipelines, LNG trade and energy security.

Associate Professor N. A. Ahmed

Dr N. A. Ahmed is an Associate Professor at the University of New South Wales, Australia. Currently Head of Aerospace Engineering, the Director of Aerodynamic research and laboratory facilities and Director of External facilities of the School of Mechanical Engineering at this University. He has worked in the industry and academic establishments and has a demonstrated record of generating new concepts and bringing the concepts into reality: a commercial flow meter called Vortex II for Kent Industrial Measurements (1984), UK; a novel 3D fibre optic LDA for Cranfield University (1987), UK, and innovative wind driven ventilators in Australia. In 1989, he became the Manager of the Compressor research facility at Cranfield, the largest such test facility in Europe and worked in collaboration with Rolls Royce (UK), Snecma (France), Turbomeca (France) and several other European companies. He has been very active in various aspects of aerodynamic research where environmental issues have featured prominently from the utilization of wind as a natural source of energy and ventilation, validation and extension of a new theory called 'The highly loaded theory' for the design of rotors for wind turbines and the development of experimental and theoretical methods for performance improvement of wind driven ventilators. These studies have contributed to design of the 'Hurricane' ventilator producing 15% greater air extraction at low speed and the 'ECOPOWER', of CSR Edmonds Products Ltd, Australia that won the 2008 AIRAH Excellence award in the HVAC-Achiever category. The above works were also selected as examples of high achievements in research outcomes and reported to Australian parliament in the Australian Research Council Annual submissions in 2004 and 2009. He has published extensively, written several book chapters on advancing the cause of wind as a natural source of energy production and usage, ventilation inside building and wind tunnel development and measurement techniques. He has delivered Plenary addresses to the International Conference on Mechanical, Industrial and Energy Engineering in December, 2010, International Conference on Energy, Environment and Sustainable Development, Shanghai, China, in October 2011.and was recently invited by the European Association for the Development of Renewable Energies, Environment and Power Quality (EA4EPQ) Commission for a Plenary address at the 'International Conference on Renewable Energies and Power Quality (ICREPQ'12), held in Spain in March 2012.

KEYNOTE SPEAKERS

Professor Adesoji Adesina

Professor Adesoji Adesina has a PhD in Chemical Engineering from the University of Waterloo, Canada. He has been with the University of New South Wales since 1991 where he directs the Reactor Engineering & Technology Group. His research activities focus on the development of innovative reactor systems for energy and environmental technologies.

Associate Professor John Asafu-Adjaye

John is currently an Associate Professor of Economics in the School of Economics, The University of Queensland, Brisbane, Australia. He has research interests in natural resource and environmental economics, in particular, climate change and energy economics. John has carried out research and consultancy work on environment and economic development issues in Australia, Ghana, Papua New Guinea, Brunei Darussalam, Indonesia, Fiji, Vietnam, and China. Topics investigated include computable general equilibrium modelling, economic evaluation of proposed projects, feasibility studies, climate change impacts and mitigation, environmental impact assessment, socioeconomic impact assessment. Asafu-Adjaye is the author/co-author of over 70 research-based publications, including eight books and monographs, five book chapters, 49 refereed journal articles, and 11 commissioned reports. His book, Environmental Economics: An Introduction for the Non-Economist: Tools and Policies for Sustainable Development (2005, World Scientific Publishing) is in its 2nd Edition, and has been well subscribed to date. He has recent publications in top tier journals such as The World Economy, Energy Policy, Energy Economics, Energy and Contemporary Economic Policy.

THE INTERNATIONAL ENERGY CONGRESS 17-18 SEPTEMBER 2012 EVOLVINGENERGY

Professor Javid Bayandor

Prof. Bayandor is the Director of CRashworthiness for Aerospace Structures and Hybrids (CRASH) Lab at the Center for Intelligent Material Systems and Structures in Virgina Tech, VA, USA. Prof. Bayandor received his PhD in Aerospace Engineering from the Royal Melbourne Institute of Technology. His research and innovation in the area of advanced unsteady propulsion, contributing to the renewable energy field, has been recognized internationally and has been named after his pioneering work in the area of propulsion. Professor Bayandor is the Fellow of the International Energy Foundation, The Royal Aeronautical Society and an associate fellow of the American Institute of Aeronautics and Astronautics. Throughout his career, Prof. Bayandor has directly worked with several international research organizations in a variety of aerospace related programs. Some of the organizations include Airbus Deutschland GmbH, Cooperative Research Centre for Advanced Composite Structures, German Aerospace Center, Massachusetts Institute of Technology, The Sir Lawrence Wackett Aerospace Centre, the Royal Melbourne Institute of Technology, etc. Prof. Bayandor is the Chair for the American Society of Mechanical Engineers Fluid Mechanics Technical Committee.

Professor Hui Tong Chua

Hui Tong Chua is a Winthrop Professor in the School of Mechanical and Chemical Engineering, The University of Western Australia. He is also the Program Chair of the Chemical Engineering Program. Hui Tong was the Aboveground Engineering Program Leader of the Western Australian Geothermal Centre of Excellence from 2009 to 2012, and responsible for the aboveground implementation of geothermal air conditioning and desalination systems. His research focuses on renewable and clean energies, and work in a range of areas which include low grade heat desalination, geothermal air conditioning, heat driven chillers, and emission free catalytic cracking of methane for hydrogen and graphitic carbon. In 2011, he was inducted by the China Shanxi Government into the Shanxi Province Hundred Man Program, and is currently a specially appointed professor at the Taiyuan University of Technology in Shanxi Province, China.

Professor Thomas Faunce

Professor Thomas Faunce holds a joint appointment in the College of Medicine, Biology and the Environment and College of Law at the Australian National University. He is the recipient of a prestigious Australian Research Council (ARC) Future Fellowship, the holder of four ARC Discovery Project competitive research grants and has published over a hundred refereed articles, over twenty book chapters and three books in the field of health technology regulation. He serves on the board of management of the ANU Energy Change Institute. In August 2011 he coordinated the first International Conference dedicated to the creation of Global Artificial Photosynthesis Project at Lord Howe island. He was an invited speaker on this theme before the United Nations in Geneva in December 2011 and at the meeting of the Solar H2 network in Uppsala in November 2011. His latest book with Edward Elgar (to be published this year) is entitled; 'Nanotechnology for a Sustainable World: Global Artificial Photosynthesis as the Moral Culmination of Nanotechnology.'

PROF. IR. DR. Abd. Halim Shamsuddin

Prof. Abd Halim Shamsuddin is currently the Director, Centre for Renewable Energy, Universiti Tenaga Nasional, a private university wholly-owned by Tenaga Nasional Berhad, the largest power utility company in Malaysia. He graduated from the University of Leeds, United Kingdom, with B.Sc. (Hons.) in Fuel and Energy Engineering in 1979 and Ph.D. in Combustion in 1983. Prof. Halim has over 30 years of experiences in research as an academic at Universiti Kebangsaan Malaysia and Universiti Tenaga Nasional. His research interests and focus areas include: Combustion Processes, Technologies and Systems; Biomass Resources and Energy; Thermal Treatment of Wastes; Renewable Energy; Fuels. He is a Professional Engineer registered with the Board of Engineers Malaysia, and a Chartered Engineer registered with the Engineering Council United Kingdom. He is a Member of the Energy Institute United Kingdom, and the Chairman of Energy Institute Malaysia, an overseas Branch of the EI UK. Prof. Halim is also an active member of a number of National Committees in Ministries/Agencies, and is the Chairman of the Malaysian Mirror-Committee ISO/TC-238 Solid Bio-fuel. He is also currently providing technical expertise and advice to the Biomass industry in Malaysia.

Professor Aleksandar Subic

Professor Aleksandar Subic is the Head of School of Aerospace, Mechanical and Manufacturing Engineering at RMIT University in Melbourne, Australia which incorporates the Sir Lawrence Wackett Aerospace Research Centre. He is also at present Director of the Society of Automotive Engineers Australasia (SAE-A), Director of Australian Association of Aerospace and Aviation Industries and Education Director of Corporate Research Centre for Advanced Automotive Technologies (AutoCRC). He has around 25 years of educational and research experience at universities world wide. His particular research focus is on sustainable engineering design and development, including green vehicle and sports technologies and sustainable manufacturing. He has published over 250 international peer reviewed journal articles, book chapters and books, and conference papers and has undertaken a wide range of high impact research projects in collaboration with industry. He is the Co-Chair of the International Conference series on Sustainable Mobility and Editor-in-Chief of the International Journal of Sustainable Design and Sports Technology Journal published by Routledge, Associate Editor of International Journal of Vehicle Design and is on a number of international Editorial Boards including European Journal of Engineering Education published by Taylor & Francis. He has received a number of awards and international fellowships for his research work.

Professor Behdad Moghtaderi

Behdad Moghtaderi is a Professor of Chemical Engineering, the Deputy-Director of the Priority Research Centre for Energy, and Head of Chemical Engineering at the University of Newcastle (Australia). He received his PhD and MES degrees from the University of Sydney in 1997 and 1994, respectively and his bachelor degree from Shiraz University in 1989. The underlying theme of Behdad's research is "Thermo-Fluid Engineering" encompassing applications in the general field of energy and the environment. The focus of his research is development of technologies suitable for direct/indirect minimisation of greenhouse emissions, particularly in application areas, such as: renewable energy systems (geothermal power, biomass utilisation), advanced clean coal technologies (e.g. oxy-fuel and chemical looping combustion), hydrogen powered micro-energy systems, and energy efficiency. Behdad has published in excess of 200 scholarly articles in international journals, and conferences, authored two books and holds six patents. Behdad is a co-inventor of the GRANEXTM heat engine which is being marketed internationally by Granite Power Pty Ltd. Since joining the University of Newcastle in 1999 Behdad has attracted in excess of $16M research funding predominately from the Australian Research Council (ARC) and Industry. Behdad is a fellow of the Institution of Engineers Australia (IEAust) and the Australian Institute of Energy (FAIE), and the former Honorary Secretary of the Combustion Institute (Australia and New Zealand Section). He also serves on the editorial boards of several scholarly journals in the field of energy. Thirteen (13) PhD students have completed their studies under Behdad's supervision and 12 other postgraduate students and 7 postdoctoral fellows are currently pursuing their studies under his guidance.

INVITED SPEAKERS

Kim Lee Chang

Kim Lee Chang is a final year PhD student at the UTAS School of Plant Science. He completed his BBiotech (Hons) studying genes associated with acid stress in Listeria in 2007, and then worked in the School of Plant Science honing his skills in thraustochytrid culture techniques and biodiscovery. He started his PhD with UTAS and the CSIRO Energy Transformed National Research Flagship in September 2009 and his research project is 'Microalgae - A Renewable Source of Biofuels, Omega-3 Oils and Other Co-products' . He has identified new strains of highly productive thraustochytrids and by optimising growth conditions has been maximising their potential for biofuels and Omega-3 oils production. Kim was awarded - best fisheries poster presentation sponsored by the Australian Fisheries Management Authority at the 2010 Australian Marine Sciences Association conference; best poster presentation by the Australian Institute of Energy Tasmania Branch (2010) and represented the AIE Tasmania Branch in the AIE National Postgraduate Student Energy Awards; the Rodney Mailer student award at the 2011 American Oil Chemists' Society Australasian Section conference. His research to date has been published in several leading international journals.

Associate Professor Vladimir Strezov

Dr Strezov is Associate Professor and Environmental Science Program Director at the Graduate School of the Environment, Macquarie University. He completed his PhD in Chemical Engineering at the University of Newcastle where he jointly worked with the pyrometallurgy research team of BHP Research Laboratories. Before joining Macquarie University in 2003 he was a research associate and laboratory manager at the University of Newcastle. A/Prof Strezov's current research projects are concerned with improvement of energy efficiency and reduction of emissions in minerals processing, electricity generation and production of biofuels. He has established close links with several primary industries leading to successful joint projects in the field of energy and sustainability. He currently manages a laboratory for thermal and environmental processing funded in collaboration with the Rio Tinto Group. The primary focus of this collaboration is to study energy requirements of the minerals processing industries with a potential to increase energy efficiency and improve emissions."

Professor Gerry Swiegers

Professor Gerry Swiegers is Vice-President R&D at Datatrace-DNA P/L, a company formed from his research in 2005, and a Fellow at the Australian Research Council's Centre of Excellence for Electromaterial Science at the University of Wollongong, Australia. He was previously a research group leader at CSIRO Molecular and Health Technologies in Melbourne.

Dr. Attila Janos Mozer

Dr Attila Janos Mozer is an Australian Research Fellow (2011 -) and a Senior Research Fellow (2010 -) at the Intelligent Polymer Research Institute at the University of Wollongong. Dr Mozer is the lead chief investigator of three Australian Research Council grants focused on developing cost-efficient solar energy conversion systems using organic solar cell technology. His main expertise is studying solar cell efficiency-determining charge photo-generation and recombination reactions using time-resolved optical and electronic probes. Dr Mozer has a significant track record in two of the major organic solar cell architectures: donor / acceptor polymer bulk heterojunction solar cells and dye-sensitised photo-electrochemical solar cells. He has an h index of 14, and has published (since 2004) three book chapters and 31 publications with total citations exceeding 600. He has obtained his PhD from Prof. Serdar Sariciftci, the inventor of polymer solar cell technology at the Linz Institute for Organic Solar Cells, Johannes Kepler University, Linz, Austria in 2004. He has obtained his MSc in Chemical Engineering from the Budapest University of Technology and Economics in 2002. Dr Mozer has received research fellowships including the Australian Research Council ARF Fellowship (2011 -), the Japanese Society for the Promotion of Science Short-Term Visiting Fellowship (2011 -) and Postdoctoral Fellowship (2005).

Dr Mirek Piechowski

Mirek Piechowski is an Associate and Group Leader at the Meinhardt Building Science Group where he provides professional leadership and management for the multidisciplinary team of scientists and engineers. The Group is involved in developing innovative and cost effective building design solutions focused on energy efficiency, occupant comfort and ecological sustainability. Meinhardt is an international engineering consulting firm with over 20 offices in 13 countries across four continents employing approximately 3,500 staff. The Building Science Group is a centre of excellence for the global Meinhardt Group in the area of sustainability, resource efficiency and building physics. Dr Piechowski specialises in building physics, thermodynamic analysis and design of thermal energy systems in the context of built environment and renewable energy infrastructure. His recent academic and industry work is focused on developing integrated built environment and low grade, renewable energy infrastructure solutions for medium and large scale developments. He is active in publishing and presenting at conferences and seminars internationally and locally. Dr Piechowski is a Founding Director of the Centre for GeoExchange and Renewable Energy Infrastructure and a LEED Accredited Professional with extensive project experience in the Middle East, South East Asia and Australia.

IEF-110	PLENARY PRESENTATION: DEVELOPMENT OF NANO-MATERIALS FOR ENERGY APPLICATIONS AT INSTITUTE FOR SUPERCONDUCTING AND ELECTRONIC MATERIALS (ISEM)

Professor Shi Xue Dou

University of Wollongong, Australia

The Institute for Superconducting and Electronic Materials (ISEM) has built an interdisciplinary research capability in advanced materials and technology for energy applications including batteries, supercapacitors for energy conversion and storage, thermoelectric, magnetocaloric, thermionic materials and fuel cells for waste energy recovery and energy generation, superconductors for energy transmission, storage and electrical devices. Wides pread adoption of electric vehicles (EVs) has immense potential for social, economic and environmental benefits. However, the major challenges that are impeding the widespread uptake of EV's, including short driving range, difficulties to recharge, safety and high cost, must be addressed. Significant advances already made by our group include high capacity anodes using carbon coated nanoscale Si and nanowire SnO2, composite oxide/carbon nanotubes, and high capacity and high power cathodes using nanocomposites. The work on alloyed LiFePO4/C nanocomposite showed a fast charging rate within several minutes with long cycling stability over 1000 cycles. These advances represent important milestones in the development of high power and high energy density batteries and supercapacitors for electric vehicles. In superconductivity area, we have made a breakthrough in the fabrication of wires from the superconductor magnesium diboride by using nano-scale doping. They have achieved a world record high critical current carrying capacity in superconducting MgB2 wires and a record high upper critical field for the nano-scale SiC doped MgB2. This is one of the most important advances since the discovery of superconductivity in this material and has an important impact on the development of technological uperconductors. This emerging superconductor would have practical applications, such as wind turbine generators, magnetic resonance imaging (MRI), fault current limiters, power cables, motors, energy storages, generators, magnetic separators and transformers, and will lead to enormous energy and cost savings. There are 58% energy wasted in the form of heat, recovery of waste heat in steel and iron making companies and automotives is one of our research focuses. This goal will be achieved by developing thermoelectric generators. Our group has developed Al-containing ZnO nanocomposites with up to a factor of 20 lower thermal conductivity than non-nanostructured ZnO, while retaining bulk like electrical conductivity. The resultant figure of merit (ZT) at 1000 K is 50% higher than that for the best non-nanostructured counterpart material at the same temperature and holds promise for engineering advanced oxide-based high-ZT thermoelectrics for applications.

IEF-111	PLENARY PRESENTATION: SMART GRIDS: A BIRD'S EYE VIEW

Professor Xinghuo Yu

RMIT University, Australia

Smart Grids are electric networks that employ innovative and intelligent monitoring, control, communication, and self-healing technologies to deliver better connections and operations for generators and distributors, flexible choices for consumers, and reliability and security of electricity supply. Smart Grids are complex networks in nature that face many new theoretical and practical challenges for the future developments. In this talk, we will first give a brief overview of Smart Grids and their recent developments, and then examine the key research issues in Smart Grids from systems, control and information technology viewpoints. Some of our recent research in this field will be highlighted at the end.

IEF-112	PLENARY PRESENTATION: ENERGY DEMAND AND RELIABILITY OF SUPPLY

Robert Pritchard

ResourcesLaw International, Australia

This paper will analyse how growth in energy demand has outstripped the capacity of the oil exporting countries to guarantee reliable supply. It is a problem which policymakers in importing countries cannot regulate because they have little or no control over population growth, economic growth, industrialisation, motorisation or urbanisation. It is also a problem which many exporting countries find increasingly difficult to address because of their latent political volatility. Ten countries produce half of the world's oil supply but their governance is becoming more and more problematic. In theory, this should not matter because they all depend on oil revenues for their prosperity but in reality it does matter as recent instability in the Middle East and North Africa is showing.

*Papers marked with * have been subject to full peer review.*

THE INTERNATIONAL ENERGY CONGRESS 17-18 SEPTEMBER 2012 EVOLVINGENERGY

IEF-113	PLENARY PRESENTATION: NEW HORIZONS OF APPLICATIONS OF THE 21ST CENTURY AERODYNAMIC CONCEPTS FROM AEROSPACE TO POWER GENERATION AND UTILIZATION

Associate Professor N.A. Ahmed

University of New South Wales, Australia

The rapid technological development of the last century has underpinned the progress of modern civilization but is also giving rise to unnatural contingencies of energy production and utilization that are raising serious alarm bells because they have the potential to destroy the very environment which sustains life. The matter of energy production and usage, therefore, needs to be tackled on every possible front with a greater sense of urgency. This is the background against which research, at the University of New South Wales by the author and his team, are being conducted. Although the work originally started with applications to aerospace industry in mind, it has become evident that some of the novel techniques and concepts developed as a consequence, would have wider applications opening up new horizons of research of positive scientific, economic and environmental significance. The present talk is, therefore, organised essentially around the experiences and outcomes of such works that have the great promise of applications in a wide range of diverse fields, from performance enhancement of aircraft flight to power generation using renewable sources of energy, from propulsion of micro-aerial and underwater unmanned vehicles to ventilation within enclosed spaces of aircraft cabin or helicopter cockpits, from the design of thermal protection system for re-entry space vehicles to the energy efficient design of dwellings for human and domesticated animals, all with the overriding goal of contributing towards reducing carbon foot print and facilitating a sustainable environment of high quality living and comfort.

IEF-114*	KEYNOTE PRESENTATION: A NOVEL CONTINUOUS EXTRACTIVE REACTOR FOR BIODIESEL PRODUCTION USING LIPOLYTIC ENZYME

Dean M. Chesterfield[a], Peter L. Rogers[b], Essam O. Al-Zani[a] and Adesoji A. Adesina[a]

[a] Reactor Engineering and Technology Group, School of Chemical Engineering, University of New South Wales, Australia
[b]School of Biotechnology and Biomolecular Sciences, University of New South Wales, Australia

There is currently a need to improve the commercial feasibility of lipasic biodiesel production in order to make it an attractive alternative to conventional biodiesel processes. One such means is to apply process intensification principles, by combining reaction and product separation steps into a stirred countercurrent extractive reactor (XRC). Benefits include continuous operation, enhanced biodiesel yield via removal of by-products into a separate phase and lower capital and operating costs due to fewer unit operations. This study involves steady-state modelling of an 8-stage XRC employing oil feed and aqueous ethanol solvent, using lipase as catalyst. Modelling utilised commercial process simulation software coupled to an iterative method for estimation of dispersed phase holdup to investigate the influence of operating conditions and feed compositions on XRC performance. Results suggest the optimum solvent composition lies in the range of 50 – 70 vol% ethanol for oil feeds containing between 0 – 50 wt% free fatty acids. Increasing stage efficiency was detrimental to biodiesel yield, indicating that non-ideal reactive stages are preferable in the XRC. Incorporation of a raffinate recycle stream improved biodiesel yield, while recycling extract led to only minor downturn in yield and glycerol recovery provided that solvent to feed ratio was maintained above 1.5.

IEF-115*	KEYNOTE PRESENTATION: IS THERE A ROLE FOR BIOFUELS IN PROMOTING ENERGY SELF SUFFICIENCY AND SECURITY? AN ANALYSIS OF BIOFUEL POLICY IN THAILAND

John Asafu-Adjaye[a], Suthin Wianwiwat[b]

[a]School of Economics, The University of Queensland, Australia
[b]Faculty of Management Science Khon Kaen University, Thailand

Given the rising price of crude oil, some developing countries including Thailand are looking towards developing their domestic renewable energy resources, in particular biofuels. However, there are concerns about the possible adverse effects such a policy strategy would have on key variables such as sectoral output, land allocation and the effects of prices, particularly food prices. This study develops a computable general equilibrium (CGE) model of the Thailand economy that features enhancements of the energy sector and uses it to analyse the government's recent renewable energy development plan. This plan aims to increase domestic energy use from renewable sources to replace fossil fuel imports. The study simulated specific policies contained in the plan. Among other things, we found that promoting biofuel use causes a rapid increase in the price of biofuel and biofuel feedstock in the short run, whereas these prices only increase slightly in the long run due to more elastic supplies. Furthermore, the prices of food including other products marginally increase, implying that food security is not undermined by the policy. On the basis of the findings, the study recommends review of some of the targets because they were found to be too high, and a phasing in of others.

IEF-116	KEYNOTE PRESENTATION: BIO-INSPIRED REVOLUTION IN EMERGING ADVANCED RENEWABLE ENERGY AND UNSTEADY PROPULSION CONCEPT

Javid Bayandor

Crashworthiness for Aerospace Structures and Hybrids (CRASH) Lab Virginia Tech, USA

In the recent decades, a major shift to understanding and utilizing renewable energy resources has been signified. However, in response to this shift, most development efforts aiming at the efficient capture of renewable energy resources have been purely based on traditional mechanical principles. Consequently, the technology applied has often led to over-designing less efficient energy systems, while ignoring simple, yet ingenious, ways by which the nature, intertwined with the laws of physics, has addressed its energy harvesting and delivery problems. This talk will focus on a number of biological findings and the ensuing bio-inspired innovations in the areas of wind and hydro power and unsteady propulsion. It will be shown that the discoveries highlighted not only offer to transform the both fields -as well as many others, but the preconceived notion that today ¢s technology might have reached a plateau within which only incremental progression would be possible. Some of the many forms of wake-vortex phenomenon in the nature, in particular relation to the locomotion of several distinct species on land, in air and water, will be discussed. It will be demonstrated how a discerned take on such bio-solutions can help inspire creative means to extract energy more efficiently and devise novel unsteady propulsive systems for aerial and under-water vehicle concepts. The focus of the talk will be given to a modern bio-inspired large amplitude unsteady propulsion that can shed free trailing vorticity of magnitude O(å0) per unit of time down-stream of the flow. Having multiple degrees of freedom, the system has been designed to efficiently operate in transitional and unsteady flows through sensing and capturing the energy of flow perturbations and turbulence, in addition to that of the free-stream. Furthermore, a developed unique flying concept inspired by the exact kinematics of a flight type in the nature, will be introduced.

IEF-117	KEYNOTE PRESENTATION: LOW GRADE HEAT DRIVEN MULTI-EFFECT DISTILLATION DESALINATION TECHNOLOGY

Hui Tong Chua

School of Environmental Science and Engineering,
Taiyuan University of Technology, China
School of Mechanical and Chemical Engineering, The University of Western Australia, Australia

In the recent decades, a major shift to understanding and utilizing renewable energy resources has been signified. However, in response to this shift, most development efforts aiming at the efficient capture of renewable energy resources have been purely based on traditional mechanical principles. Consequently, the technology applied has often led to over-designing less efficient energy systems, while ignoring simple, yet ingenious, ways by which the nature, intertwined with the laws of physics, has addressed its energy harvesting and delivery problems. This talk will focus on a number of biological findings and the ensuing bio-inspired innovations in the areas of wind and hydro power and unsteady propulsion. It will be shown that the discoveries highlighted not only offer to transform the both fields -as well as many others, but the preconceived notion that today ¢s technology might have reached a plateau within which only incremental progression would be possible. Some of the many forms of wake-vortex phenomenon in the nature, in particular relation to the locomotion of several distinct species on land, in air and water, will be discussed. It will be demonstrated how a discerned take on such bio-solutions can help inspire creative means to extract energy more efficiently and devise novel unsteady propulsive systems for aerial and under-water vehicle concepts. The focus of the talk will be given to a modern bio-inspired large amplitude unsteady propulsion that can shed free trailing vorticity of magnitude O(å0) per unit of time down-stream of the flow. Having multiple degrees of freedom, the system has been designed to efficiently operate in transitional and unsteady flows through sensing and capturing the energy of flow perturbations and turbulence, in addition to that of the free-stream. Furthermore, a developed unique flying concept inspired by the exact kinematics of a flight type in the nature, will be introduced.

*Papers marked with * have been subject to full peer review.*

IEF-118*	TOWARDS A GLOBAL SOLAR FUELS PROJECT- ARTIFICIAL PHOTOSYNTHESIS AND THE TRANSITION FROM ANTHROPOCENE TO SUSTAINOCENE

Thomas Faunce

College of Medicine, Biology and the Environment and College of Law,
Australian National University, Australia

The development of an economy based on practical solar fuels is chiefly predicated on obtaining cheap and abundant hydrogen by using photons to split water, then cooling or compressing that gas; or on combining such hydrogen with carbon dioxide obtained from abundant industrial sources and eventually the atmosphere to create methanol. The construction of devices to make such fuels will be a major step in shifting the biosphere from what has been termed the Anthropocene to the Sustainocene epoch. Solar Fuels, particularly those derived from nanotechnology-based artificial photosynthesis represent an 'off-grid' energy, water and climate change solution that may directly challenge substantial investments in 'ancient photosynthesis' fuels by the World bank and multinational corporations in the energy sector, as well as government subsidies. This paper will examine immediate and long-term prospects and potential mechanisms for facilitating collaboration between the major existing national and regional Solar Fuels projects or establishing a macroscience Global Solar Fuels (GSF) initiative.

IEF-119*	KEYNOTE PRESENTATION: DEVELOPMENT OF RENEWABLE ENERGY IN MALAYSIA – STRATEGIC INITIATIVES FOR CARBON REDUCTION IN THE POWER GENERATION SECTOR

Abd Halim Shamsuddin

Centre for Renewable Energy, Universiti Tenaga Nasional, Malaysia

Malaysia introduced renewable energy as the 5th fuel strategy in the energy-mix under the National Energy Policy in 2001. A target was set at 500 MW grid-connected power generations by 2005 from renewable energy sources. The small renewable energy power program (SREP) was launched at the same time with fiscal incentives to support this initiative. Malaysia has huge potential renewable energy resources in the form of biomass, solar and hydro. However, the implementation of SREP was not up to expectation due to several barriers and challenges faced by the authorities and developers, and the target was revised in 2006 to 350 MW by 2010. At the COP15 in Copenhagen, Malaysia pledged a voluntary reduction of up to 40% in terms of emissions intensity of GDP by the year 2020 compared to 2005 levels. With this commitment the Renewable Energy Act (RE Act 2010) was enacted in 2011 with provision of Feed-in Tariff, providing more attractive incentives to spur the implementation of grid-connected power generation from renewable energy resources. With the new RE Act2010, the target is revised to 985 MW by 2015, 2,080 MW (2020) and to 21,000 MW in 2050. This paper describes the development of renewable energy policy framework, strategies and initiatives for renewable energy implementation in Malaysia, in an effort to reduce carbon emissions as pledged at the COP15. This paper also provides examples of renewable power generation currently implemented and the on-going research and development activities to enhance the exploitation of renewable energy resources in Malaysia.

IEF-120	ENERGY OPTIONS FOR SUSTAINABLE MOBILITY

Aleksandar Subic

School of Aerospace, Mechanical and Manufacturing Engineering
RMIT University, Australia

Mobility is an essential part of our lives. The ability to move freely is central to meeting our social and economic needs. Today there are over 900 million vehicles on the world's roads with over 60,000,000 new vehicles produced each year worldwide. The scale of the automotive industry is enormous and far reaching. It is estimated that around two thirds of world's oil output goes to transportation whereby road vehicles alone consume around 40%. Transportation accounts for around 25% of greenhouse emissions worldwide, whereby 90% of transport related emissions come from road vehicles, predominantly cars. Clearly, current levels of consumption and emissions are unsustainable. The challenge of developing new sustainable energy options for road transport confronts our societies. Based on current knowledge it is becoming painfully clear that there is no "silver bullet" or single technology available at present to address this challenge. To succeed we will most likely have to pursue a range of different options and technologies with short-term and long-term gains. This presentation aims to draw particular attention to the different energy options that have the potential to meet the challenges to sustainable mobility, highlighting their advantages and limitations respectively.

*Papers marked with * have been subject to full peer review.*

IEF-121 KEYNOTE PRESENTATION: RECENT ADVANCES IN LOW EMISSION COAL TECHNOLOGIES

Behdad Moghtaderi

Priority Research Centre for Energy, Chemical Engineering
Faculty of Engineering & Built Environment, The University of Newcastle, Australia

The worldwide concern over greenhouse gas emissions and their impact on global warming has prompted a wide-reaching search for cleaner methods of power generation from fossil fuels in general and coal in particular. Combined capture and sequestration (CCS) of CO2 emissions from large stationary coal-fired power plants is regarded as one of the effective means of abating greenhouse gas emissions in short to medium terms. In this context, the pivotal role of CO2 separation/capture technologies cannot be overstated, as this step has the greatest cost and energy penalty of the CCS technology options. This presentation provides an overview of advanced CO2 capture technology options suitable for power generation from coal with near-zero to zero greenhouse emissions footprints. A range of technologies in categories such as pre-combustion, post-combustion, and oxy-firing will be examined. A particular attention will be given to emerging technologies based on the Chemical Looping concept. In addition to CO2 capture technologies, a number of novel technology options for enhancing the energy efficiency of coal-fired power plants will be also discussed. The emphasis will be on hybrid renewable assisted power generation systems.

IEF-122 INVITED PRESENTATION: HETEROTROPHIC MICROALGAE FOR BIOFUEL PRODUCTION

Lucas Rye[1], Kim Lee Chang[2], D. Batten[1]

[1]Energy Transformed Flagship, CSIRO, Australia
[2]Marine and Atmospheric Research, CSIRO, Australia

Limited biomass feedstock availability is expected to restrict industry uptake of bio-refined transportation fuel (Rye et al. 2010). Cultivation of microalgae as a second generation feedstock for bio-oil production – which may then be upgraded using hydroprocessing techniques – may provide a solution. The vast majority of the research / start-up organisations are focusing on cultivation of phototrophic algae for bio-oil production (photosynthesis). Phototropic raceway cultivation however, provides low biomass dry weight yield per litre of cultivation medium, with values of 0.3 gl-1d-1 (i.e. 20 gm-2d-1) frequently cited. This dilute culture throughput significantly increases processing cost (i.e. harvesting, dewatering and oil extraction) and thus represents a significant economic barrier if the system is designed to produce only low value bio-oil. Cultivation of heterotrophic microalgae has the potential to provide significantly higher biomass yields according to figures published by Wu et al. Tsinghua University group. The most recent work from this group established an equivalent bio-oil yield of 8.3 ml per cultivation litre per day (Yan et al. 2011). This has been confirmed at CSIRO, where heterotrophic cultivation yields were found to exceed Yan et al's published data. Our work seeks to investigate the potential for heterotrophic microalgae to provide Australia's commercial aircraft fleet with a secure, environmentally sustainable alternative fuel feedstock through a triple bottom line analysis. Results from the analysis, based on CSIRO data, will be presented.

IEF-123 INVITED PRESENTATION: SUSTAINABILITY CHALLENGES OF ELECTRICITY GENERATION TECHNOLOGIES

Vladimir Strezov, Annette Evans, Tim Evans

Graduate School of the Environment, Faculty of Science, Macquarie University, Australia

Electricity generation technologies face growing environmental, economic and social sustainability challenges primarily due to excessive fossil fuel use for power generation. This work defines the sustainability of all major energy generation technologies according to a set of indicators, including electricity price, efficiency of generation, greenhouse gas emissions, availability and limitations of each technology, land and water use requirements, and social impacts. Each indicator was quantified considering full life cycle of the energy generation plant. The social impacts were quantified through the statistical results of a survey. The electricity generation technologies were then ranked against each other and it was found that wind, ranked as most favourable, followed by hydropower. Electricity generation from dedicated energy crops ranked the lowest, even lower than coal fired power generation, which ranked as the second last. One of the most significant challenges faced by the renewable energy generation technologies, in particular wind and solar, was found to be the intermittency of their availability, hindering their reliability. For this reason, energy storage is expected to become one of the most important complementary technologies that will significantly increase the penetration potential of intermittent renewable energy sources. The types of energy storage technologies are also reviewed here.

*Papers marked with * have been subject to full peer review.*

THE INTERNATIONAL ENERGY CONGRESS 17-18 SEPTEMBER 2012 EVOLVINGENERGY

IEF-124 INVITED PRESENTATION: HOMOGENEOUS CATALYSTS WITH A MECHANICAL ("MACHINE-LIKE") ACTION. CATALYTIC SOLAR WATER SPLITTING INSPIRED BY PHOTOSYNTHESIS

Gerry F. Swiegers

Intelligent Polymer Research Centre, ARC Centre of Excellence for Electromaterial Science, University of Wollongong, Australia

Chemical reactions may be controlled by either: (1) the minimum threshold energy that must be overcome during collisions between reactant molecules / atoms (the Activation Energy, Ea), or: (2) the rate at which reactant collisions occur (the Collision Frequency, A) (for reactions with low Ea,). Reactions of type (2) are governed by the physical, mechanical interaction of the reactants. Such mechanical processes are unusual, but not unknown in molecular catalysts. In this presentation we examine the nature of the action in several abiological mechanical catalysts. We show that the catalytic action is machine-like in that it depends on synchronized, dynamic interactions driven by a mechanical impulse, which is, in this case, conformational flexing of the catalyst molecule. Catalysts that act like molecular "machines" are Complex in their actions and provide examples of Complex Systems. This is because they involve multiple components interacting cooperatively in a synchronized, time-dependent manner. In the absence of the necessary synchronization, each individual component within a machine is unable to achieve a useful effect and is therefore quite useless. We describe a [1.1]ferrocenophane molecular catalyst that employs a mechanical action to generate H2 from acidic H2O. Under illumination by sunlight, this catalyst generates, continuously, over 5 days of testing, 5 molecules H2 s-1 catalyst-1. Several of the biological catalysts, known as enzymes, also appear to display characteristics of a mechanical action. We have, consequently, developed a model of the Photosystem II Water Oxidizing Complex found in all photosynthetic organisms, that spontaneously oxidizes water when illuminated with light under a bias of 1.00 V (vs. Ag/AgCl). This catalyst, which generates O2 continuously from H2O over at least 65 h of testing, achieves average turnover frequencies of 24 molecules O2 h-1 catalyst-1 and peak turnover frequencies of 270 molecules O2 h-1 catalyst-1. Recent work has shown that the latter catalyst readily redox couples with Ru(bipyridyl) dyes of the type used in Dye-Sensitized Solar Cells, such as the Graetzel cell. This has allowed us to build and demonstrate a free-standing, self-contained Dye-Sensitized Solar Cell that spontaneously splits water into hydrogen and oxygen when illuminated with sunlight. No external bias is required as the DSSC generates its own electrical current and voltage upon illumination. An electrolyte of distilled water, or even of seawater, can be used.

IEF-125 INVITED PRESENTATION: CHARGE PHOTO-GENERATION AND RECOMBINATION IN POLYMER SOLAR CELLS: A SCIENTIFIC ROADMAP TOWARDS 15% POWER CONVERSION EFFICIENCY

Attila Janos Mozer

ARC Centre of Excellence for Electromaterials Science, Intelligent Polymer Research Institute, University of Wollongong, Australia

Ultrafast photo-induced electron transfer between a photo-excited conjugated polymer (electron donor) and fullerene (acceptor) was first reported in 1992 by Sariciftci et al. This initial discovery has led to a number of important applications in photo-detectors, bio-sensors, light-sensitive field-effect transistors and plastic solar cells. The efficiency of the first bulk-heterojunction (plastic) solar cells, where an intimate mixing of the electron donor / electron acceptor phases created large surface area for efficient charge separation, was < 1%. This year, the best reported certified efficiencies surpassed 8%3 making this low-cost technology commercially viable. Two of the most fundamentally important questions still unresolved are (i) "What is the minimum thermodynamic driving force required for efficient charge separation?"; (ii) "What governs charge recombination of the photo-induced charge carriers and how to minimise charge recombination in a well-intermixed donor/acceptor blend with high internal surface area?" In this presentation, I will show that relatively large driving force is required for efficient charge separation in the benchmark regioregular poly-3-hexylthiophene / PCBM bulk heterojunction, which significantly limits the maximum power conversion efficiency of polymer solar cells based on this system. Using sub-ns and femtosecond transient absorption spectroscopy, the kinetics of charge photo-generation in a series of low bandgap polymers with deep lying LUMO energy and thus small thermodynamic driving force will be presented. Another important limitation is the fast bimolecular recombination of photogenerated charges, which limits the active layer thickness and the light harvesting efficiency of most polymer solar cells. We have shown in 2005 using transient photoconductivity techniques that bimolecular recombination is significantly reduced in regioregular P3HT/PCBM mixture compared to the widely-accepted diffusion-controlled Langevin recombination model. This observation was attributed to the highly ordered, nanofibre-like morphology of P3HT in annealed P3HT/PCBM blends, reducing the chance for the electron and hole to meet and recombine. This year, we have reported reduced recombination in a novel silole-based low bandgap polymer/PCBM blend, which enables the fabrication of relatively thick (up to 300 nm) photoactive layers without a significant drop in charge collection efficiency. While the origin of reduced recombination is still poorly understood, it is essential for the large-scale roll-to-roll fabrication of polymer solar cells with thick active layers.

*Papers marked with * have been subject to full peer review.*

IEF-126 INVITED PRESENTATION: RENEWABLE AND ENERGY EFFICIENCY INFRASTRUCTURE FOR SUSTAINABLE CITIES

Mirek Piechowski

Meinhardt Australia Pty Ltd, Australia

Some of the challenges facing sustainable urban development include large number of stakeholders with diverse agendas, objectives and time frames. Over the past few years in Australia we are witnessing change of focus in urban development from 'green buildings' to the integration of built environment with sustainability infrastructure. This change leads to growing awareness of the need for coherent regulatory framework at all levels of government fostering sustainability as a business as usual scenario. This presentation focuses on the need for close integration of the built environment and its supporting energy infrastructure. It also highlights some of the challenges facing the development of robust business models for precinct scale renewable and energy efficiency infrastructure. This is discussed in the context of the GeoExchange Infrastructure, one of the technology solutions gaining acceptance in Australia.

IEF-127* WHERE DOES HYDROGEN FIT IN A SUSTAINABLE ENERGY ECONOMY?

John Andrews, Bahman Shabani

School of Aeropace, Mechanical and Manufacturing Engineering, RMIT University, Australia

Where does hydrogen fit into a global sustainable energy strategy for the 21st century, as we face the enormous challenges of irreversible climate change and uncertain oil supply? This fundamental question is addressed by sketching a sustainable energy strategy that is based predominantly on renewable energy inputs and energy efficiency, with hydrogen playing a crucial and substantial role. But this role is not an exclusive one as in the original concept of the 'hydrogen economy' proposed in the early 1970s. A hierarchy of spatially-distributed hydrogen production, storage and distribution centres relying on local renewable energy sources and feedstocks would be created to avoid the need for an expensive long-distance hydrogen pipeline system. There would thus be complementary use of electricity and hydrogen as energy vectors. Importantly, bulk hydrogen storage would provide the strategic energy reserve to guarantee national and global energy security in a world relying increasingly on renewable energy; and longer-term seasonal storage on electricity grids relying mainly on renewables. In the transport sector, a 'horses for courses' approach is proposed in which hydrogen fuel cell vehicles would be used in road and rail vehicles requiring a range comparable to today's petrol and diesel vehicles, and in coastal and international shipping, while liquid hydrogen would probably have to be used in air transport. Plug-in battery electric vehicles would be reserved for shorter-trips. Energy-economic-environmental modelling is recommended as the next step to quantify the net benefits of the overall strategy outlined.

IEF-128* EXPERIMENTAL STUDY OF SHROUDED MICRO-WIND TURBINE

Buyung Kosasih, Andrea Tondelli

School of Mechanical, Materials and Mechatronics Engineering, University of Wollongong, Australia

Shrouding (*diffuser augmented*) horizontal axis micro-wind turbine has been shown to be an effective way to potentially improve the performance of micro wind turbine for applications in built environments. It is well understood that the degree of the performance enhancement depends on several factors including the diffuser shape and geometries, blade airfoils, and the wind condition at the mounting site. The effect of diffuser shape and geometries is reported in this paper. Performance of diffuser with three different geometrical features namely: straight diffuser, nozzle-diffuser combination, and diffuser-brim (*brimmed diffuser*) combination have been investigated. This paper aims to compare the performance of bare and diffuser augmented turbine; and investigate the effect of the diffuser geometrical parameters: diffuser lengths (L/D = 0.63 to 1.5) and flange heights (H/D = 0 to 0.2). Tests confirmed that placing the micro turbine model inside a shroud can substantially improve its performance. The diffuser only shroud improves the performance by 60% compared to the bare turbine and the nozzle-diffuser enhancement of 63% is slightly better than diffuser only. The improvement with brimmed diffuser also shows substantial performance enhancement. Increasing the diffuser length (L/D) does not affect the optimum C_p of the wind turbine but shifts the performance curve and the optimum C_p to higher tip-speed-ratio, λ. But adding brim (*flange*) at the exit plane of the diffuser increase the performance, C_p as well as reduce the cut in speed and shift optimum λ to higher value. The finding from this work demonstrates that shrouding micro wind turbine not only improves its performance but also points out how diffuser geometrical features (L/D) and/or (H/D) can be used to design a turbine with performance curve to suit the location.

*Papers marked with * have been subject to full peer review.*

IEF-129* IMPROVING SAFETY AND PERFORMANCE OF SMALL-SCALE VERTICAL AXIS WIND TURBINES

Joshua Yen, Noor Ahmed

Aerospace Engineering, School of Mechanical and Manufacturing Engineering, University of New South Wales, Australia

Although horizontal axis wind turbines (HAWT) are considered more efficient in operation than their vertical axis wind turbine (VAWT) counterparts and are more commonly used in wind farms as large wind turbines, the VAWT may offer greater advantages in safety and operation when it comes to their application within the urban environment. Yaw control systems are an essential requirement for the safe operation of HAWT, which are costly and require high levels of maintenance, but are inherently unnecessary for VAWT. At low blade speed ratios, the performance of VAWT degrades owing to strong dynamic stall effects. This necessitates VAWT operation at high blade speed ratios to suppress them. However, the consequent large rotational speeds lead to hazardous operation especially in confined urban areas. Thus to improve the low blade speed performance, a preliminary experimental investigation has been carried out at the Aerodynamics Laboratory of the University of New South Wales on an H-type VAWT blade that employed zero-net mass flux actuation. This technique has traditionally been used for static stall delay and flow separation mitigation on aircraft wings. In the present study, large relative angles of incidence were simulated by sinusoidally oscillating the blade about its quarter-chord, and resulted in the formation of dynamic stall vortices. The application of zero-net mass flux actuation was found to have a beneficial effect on the blade aerodynamic performance by either suppressing dynamic stall or delaying its onset to higher angles of attack. This study, therefore, suggests that reduced oscillatory loads and more robust output power can be achieved with zero-net mass flux actuation on VAWT operating at low blade-speed ratios. Consequently, the findings have positive practical implications for the design of small-scale VAWT for widespread use in the urban environment.

IEF-130* CONSEQUENCE ANALYSIS OF SCARCITY USING IMPACTS FROM RESOURCE SUBSTITUTION

Shaun Rimos, Andrew F.A. Hoadley, David J. Brennan

Department of Chemical Engineering, Monash University, Australia

Published data from Australian and international sources are used to compile inputs and outputs for the combined system of fuel extraction and processing and electricity generation, for the cases of conventional natural gas, coal seam gas, and black coal fuels. A new method is being developed to assess the consequences of resource scarcity using mid-point impact indicators derived from established life cycle assessment methodology. When one particular resource such as natural gas is substituted by another resource such as coal, then the difference between the indicators corresponds to the environmental impact associated with this substitution. In this study, these differences are compared for the substitution of conventional gas with either black coal or coal seam gas to generate electricity. The results indicate lower cradle to gate impacts in global warming, acidification, particulates and solid waste generation as well as water consumption when substituting natural gas with coal seam gas. Conversely, substitution of conventional gas with black coal will result in overall higher impacts in these categories. However, coal seam gas involves greater withdrawal of underground water than in the case of the other fuels; this water requires treatment, involving production of a potentially damaging saline effluent. Potential risks may also exist arising from the large number of on-shore coal seam gas wells required per megajoule of fuel.

IEF-131* EXPERIMENTAL INVESTIGATION OF EMPLOYING ASYMMETRICAL ELECTRODES IN PROPULSION OF VEHICLES

George Matsoukas, N.A.Ahmed

School of Mechanical and Manufacturing Engineering ,University of New South Wales, Australia

Asymmetrical electrodes under high voltage which are separated by a dielectric material experience thrust towards the smaller electrode. This system of propulsion is innovative and has several unique features that distinguish it from conventional methods of propulsion. One such advantage of this phenomenon is that the electrical energy is directly converted into a mechanical force without the requirement of any moving components. However, the flow physics associated with the thrust produced on the asymmetrical electrodes is quite complex and not yet fully understood. An experimental investigation at the University of New South Wales Aerodynamics Laboratory was conducted on model asymmetrical electrodes in order to investigate its possible use in the propulsion of vehicles. A simple experimental model frame was constructed using lightweight balsa wood and asymmetrical electrodes composing of foil and wire. High DC voltage in the range of 10-35 kilo volts was used in the experiments. The results were very encouraging and thrust was observed. Further experiments involved altering parameters such as, the electrode geometry and configuration, the dielectric material and the pulsing of voltage input. When these changes were implemented, it was shown that a greater thrust was obtained. This suggests that the concept has real potential for practical application and that higher thrust may be possible with the same energy input which could pave the way for an efficient propulsion system of future vehicles with minimal energy requirements.

*Papers marked with * have been subject to full peer review.*

IEF-132*	VEHICLE CONCEPT MODELING: A NEW TECHNOLOGY FOR STRUCTURES WEIGHT REDUCTION

Pooja Doke, Mohammad Fard, Reza Jazar

School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia

The lightening of the vehicle body structure generally aggravates the noise vibration and harshness (NVH) and the crash performances of the vehicle. The development and application of the vehicle advanced computer aided engineering (CAE) allowed the vehicle designers to considerably reduce the weight and improve the structural performance of the body. However, the current advanced (detailed) CAE model can only be available in the late design phase of the vehicle when only minor changes of the structure is feasible. Unlike the detailed CAE model, which requires all detailed design, the concept CAE model can be created without any need to the detailed CAD data and it can be created in the early (concept) design phase. Accordingly, in this paper, a concept modeling method is presented for a sedan car. This model represents the major structural dynamic characteristics of the body and enables the designers to optimize the structure in terms of the performances and mass in early design phase. The detailed CAE model of the body-in-white (BIW) of vehicle is reduced to a beam elements concept-structure so that the concept structure has similar structural dynamics behavior with the corresponding test data. The developed CAE concept model demonstrates a robust method to enhance the NVH and crash performances in early stage of design. The proposed method can be used to effectively predict and optimize the vehicle body structure and support body lightweighting design process. The reduction of BIW mass will ultimately reduce fuel consumption leading to energy efficiency and reduced pollution.

IEF-133*	IMPACT OF VEHICLE ADD-ONS ON ENERGY CONSUMPTION AND GREENHOUSE GAS EMISSIONS

Harun Chowdhury, Firoz Alam, Iftekhar Khan, Simon Watkins

School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia

The primary objective of this study is to determine the impact of vehicle add-ons on energy consumption and greenhouse gas emissions (mainly CO2) for commonly used fossil fuels in passenger car. Various commonly used vehicle add-ons (police siren, advertising sign, taxi sign and roof rack) and roof load (e.g., ladder and barrel) produce additional aerodynamic drag. To measure the aerodynamic drag produced by these add-ons a wind tunnel study was undertaken using a replica reduced scale model passenger car. The aerodynamic drag for different add-on configurations were measured for a range of vehicle operating speeds and yaw angles. The results show that the vehicle add-ons have notable impact on aerodynamic drag as they can generate 5% to 40% more aerodynamic drag depending on cross wind effects. The taxi sign has minimum impact and the advertising sign has highest impact on aerodynamic drag. Also roof load such as ladder and barrel can significantly increase the drag. The aerodynamic drag was related to a range of commonly used fuels e.g., petrol, diesel, compressed natural gas (CNG) and liquefying petroleum gas (LPG) consumption, and their relative CO2 gas emissions. The results indicate that for a given range, the emission of CO2 is the highest for the CNG due to its lowest energy density.

IEF-134*	EXAMINING THE POTENTIAL OF SPLIT REACTION WATER TURBINE FOR ULTRA-LOW HEAD HYDRO RESOURCES

Abhijit Date, Ashwin Date, Aliakbar Akbarzadeh, Firoz Alam

Energy Conservation and Renewable Energy Group, School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia

Theoretical performance analysis of a split reaction water turbine for ultra-low head hydro resource is presented in this paper. The spilt reaction water turbine has shown good potential to be used for low head micro hydro-electric installations. The main advantage of this turbine is its simplicity to manufacture and reasonable energy conversion efficiency of about 65-70% (hydro to mechanical energy). Theoretical investigation has also shown a simple reaction water turbine would perform better when it spins faster. And for the simple reaction water turbine to spin faster under constant water head, its diameter should be smaller. This paper reports on a performance analysis based on the experimental data collected from different performance tests carried out on two simple reaction water turbine prototypes. Further parametric analysis of split reaction water turbine has been discussed in relation to the supply head, turbine diameter and its rotational speed. Finally this paper investigates the power production potential of an ultra-low head hydro site on a vine farm in Taggerty, Victoria, Australia. The methods used for hydro site survey are briefly discussed with the survey results over the driest period of the year. Optimum layout design of hydro system for this site is presented with the estimations of the maximum net head that is available for power production.

*Papers marked with * have been subject to full peer review.*

EVOLVINGENERGY THE INTERNATIONAL ENERGY CONGRESS 17-18 SEPTEMBER 2012

IEF-135*	EXPLORING INTERNATIONAL LEGAL GOVERNANCE OF GLOBAL SOLAR FUELS

Thomas Faunce

College of Medicine, Biology and the Environment and College of Law, Australian National University, Australia

This paper critically examines the role of international law in establishing the appropriate governance framework for enhanced global collaboration on solar fuels. It will particularly evaluate the right to enjoy the benefit of scientific progress and its applications (REBSPA) in article 15 of the United Nations International Covenant on Civil and Political Rights. Consideration will also be given to the role of declaring natural and artificial photosynthesis 'common heritage of mankind' under a UNESCO Declaration and ultimately a United Nations Convention and the impact this might have in relation to intellectual monopoly privileges (IMPs) such as patents and their capacity to advance or hinder progress in the field. It also briefly considers the role that trade and investment law and the possibility of a global carbon price may have in shaping the solar fuels field.

IEF-136*	EXPERIMENTAL INVESTIGATION OF H2 GENERATOR AND PEM FUEL CELL AS A REMOTE AREA BACK-UP POWER

Kannan Jegathala Krishnan, Akhtar Kalam and Aladin Zayegh

Victoria University, Australia

A reliable power is paramount and loss of power to communication equipment can mean loss of service to customers and loss of millions of dollars to companies. When the grid power is unavailable in remote area there are variety of back-up electrical power systems like valve-regulated lead acid (VRLA) battery systems, engine-generator sets, ultra capacitors, flywheels, and new battery technologies that strive to provide back-up power. Hydrogen Energy and fuel cell technology compete with traditional technologies meeting back-up power requirements in stationary applications. Recent collaboration between Victoria University, Sustainable Energy Fuel Cells Australia (SEFCA) and Acta Energy has resulted in thorough laboratory testing for H2 generation and data compilation of fuel cells in a back-up power operation in Power Systems Research Laboratory at Victoria University. The authors of this paper suggests that the use of EL100 H2 generator and T-1000 1.2kW PEMFC Power Generation System is capable to compete with traditional technologies to offer back-up power when there is no base load or PV or wind power. This paper presents the planning of laboratory testing, analysis and evaluation of the laboratory results. This paper also highlights the benefits of PEMFC system, EL100 H2 generator and ReliOn's T-1000 PEMFC system. Currently it is expensive to run distance trucks requiring several site visits per year in order to refill the diesel or even carrying H2 bottles to a rural site. This system generates H2 on-site and can be implemented as a back-up power in telecommunication system like the Australian National Broadband Network (NBN) where there will be need for reliable back-up power supply since NBN will be rolling out several hundred points of presence (POP's).

IEF-137*	PROSPECTS AND PROBLEMS OF INCREASING ELECTRICITY PRODUCTION FROM MID-SIZE RENEWABLE ENERGY GENERATION ON THE SOUTH-WEST INTERCONNECTED SYSTEM (SWIS) IN WA

Delphine de Babline[a], Tania Urmeea, Jamie Ally[b]

[a]School of Engineering And Energy, Murdoch University, Australia
[b]General Manager, EMC limited, Australia

Western Australia (WA) is truly blessed by abundant and readily available renewable energy resources. Yet most of its energy use still comes from fossil fuel energy. In the case of the South-West Interconnected System (SWIS), which is the largest grid of the state, renewable energy represented only 4 percent of the total electricity production in 2009-2010. From these two facts, this paper looked at the possible causes of such a small production of renewable energy and the future development of renewable energy technology for the SWIS in the coming decades. It was noticed that the SWIS and its economic and political structure tend to create barriers to renewable energy through strict market rules and lack of political will. This is particularly true for mid-size renewable energy (RE) facilities of less than 30MW, which cannot compete with traditional electricity production and are faced with technical issues to be integrated in the energy mix. In addition, strong lobby groups, encouraged by abundant fossil fuel reserves in WA, deepen the obstacles preventing fast development of renewable energy for the SWIS. There are many opinions and studies of various academic and industry experts that claim it is technically and practically possible to produce 100% of electricity from RE by 2050 in some parts of the world, which is also valid for the SWIS. However, with the current barriers and policies in place, it is very unlikely that the SWIS would achieve such an outcome. This paper discusses the barriers and driving factors of the RE sector and the possibility to improve RE production for the SWIS. It also discusses the role of the government in the energy market to increase RE penetration in the SWIS.

*Papers marked with * have been subject to full peer review.*

IEF-138* WIND TURBINE PERFORMANCE IMPROVEMENTS USING ACTIVE FLOW CONTROL TECHNIQUES

S. Shun and N.A. Ahmed

University of New South Wales, Australia

The ability of a wind turbine to react to rapid fluctuations in wind velocity is blunted by the massive rotational inertia of the rotor assembly as a whole, as well as the mass of individual blades bearing upon pitch change mechanisms. Thus, wind turbines often operate with a less than optimal relationship to the instantaneous wind conditions. A wind turbine interacting with slow fluctuations in wind velocity may suffer a loss in potential energy extraction due to stalling of the blades. Interaction with rapid fluctuations in wind velocity can subject a wind turbine to the phenomenon of dynamic stall, which produces severe variations in the aerodynamic loads upon the blades resulting in major structural issues. Flow separation is a major contributing factor to the aerodynamic challenges associated with wind turbine operation. The ability to control or reduce the magnitude of regions of separated flow over an airfoil can play a significant role in reducing the negative effects associated with turbine operations in fluctuating wind conditions. The use of Air Jet Vortex Generators (AJVG) has been shown to provide net increases in power output on full scale turbines. In addition, AJVG's have been shown experimentally to reduce the fluctuating aerodynamic loads associated with dynamic stall. Such devices are ideal for use in rapidly fluctuating conditions, as there is potential for an active flow control technique with a rapid response time which would be more difficult to achieve with fixed Vane Vortex Generators (VVG). The current work details experiments carried out with a new type of AJVG that has proven to consume less energy compared with traditional devices. The use of such a device on full scale wind turbines may lead to greater net gains in power output, as well as reducing the magnitude of aerodynamic loads associated with dynamic stall.

IEF-139* SMALL SCALE POWER GENERATION USING LOW GRADE HEAT FROM SOLAR POND

Baljit Singh[a,b], J. Gomes[a], Lippong Tan[a], Abhijit Date[a], A. Akbarzadeh[a].

[a]School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia, [b]Faculty of Mechanical Engineering, Universiti Teknologi MARA (UiTM), Malaysia.

This paper presents the potential of thermoelectric generators as a power generation system using heat from the salinity gradient solar pond. A thermoelectric cell bank module with 16 thermoelectric generators was designed and fabricated. The module was tested under varying temperature differentials to determine its performance characteristics and suitability to generate power from a typical salinity gradient solar pond. The thermoelectric generator system was designed to be powered by the hot and cold water from the salinity gradient solar pond. The system is capable of producing electricity even on cloudy days or at night as the salinity gradient solar pond acts as a thermal storage system. The results obtained have indicated significant prospects of such systems to generate power from a low grade heat for remote area power supply.

IEF-140* A NOVEL SOLAR-ASSISTED AIR-CONDITIONER SYSTEM FOR ENERGY SAVINGS WITH PERFORMANCE ENHANCEMENT

Q.P. Ha and V. Vakiloroaya

School of Electrical, Mechanical and Mechatronic Systems, University of Technology, Australia

Currently in most buildings, the heating, ventilation and air conditioning (HVAC) systems are controlled by the present temperature in the building. If the predictions for future temperature in the building or a zone were available, the building management system (BMS) could use both present and future temperatures to control HVAC systems, then the energy consumed by HAVC systems could then be minimised. Therefore, a lot of research effort has been devoted to develop accurate temperature prediction models using various approaches, e.g. traditional thermodynamic, artificial neural networks (ANN), generic algorithms (GA) and fuzzy logic approaches. When the historical data of the building is available, the ANN approach is thought to be the most cost-effective method. Most of previous studies of ANN modelling of building temperature, have either focused on single-zone examination or assumed that zones' temperatures were the same throughout the building. In this study, a more realistic multi-zone scenario in a large building is proposed in the developing of the ANN temperature predictive model. The coupled effects between zones caused by the temperature difference are considered in the model. The results of a case study show that the new ANN model that considers the temperatures of the neighbouring zones, achieves more accurate results. The proposed modelling methodology can be extended to include other inputs, besides neighboring zones' temperatures, usage pattern of the building. So that the better intelligent control strategies can be developed for energy saving purposes, based on the more accurate predicted temperatures form the new model.

*Papers marked with * have been subject to full peer review.*

THE INTERNATIONAL ENERGY CONGRESS 17-18 SEPTEMBER 2012 EVOLVINGENERGY

IEF-141* A NEW ZONE TEMPERATURE PREDICTIVE MODELLING FOR ENERGY SAVING IN BUILDINGS

Hao Huang , Lei Chen, Morteza Mohammadzaheri, Eric Hu

School of Mechanical Engineering, University of Adelaide, Australia

Currently in most buildings, the heating, ventilation and air conditioning (HVAC) systems are controlled by the present temperature in the building. If the predictions for future temperature in the building or a zone were available, the building management system (BMS) could use both present and future temperatures to control HVAC systems, then the energy consumed by HAVC systems could then be minimised. Therefore, a lot of research effort has been devoted to develop accurate temperature prediction models using various approaches, e.g. traditional thermodynamic, artificial neural networks (ANN), generic algorithms (GA) and fuzzy logic approaches. When the historical data of the building is available, the ANN approach is thought to be the most cost-effective method. Most of previous studies of ANN modelling of building temperature, have either focused on single-zone examination or assumed that zones' temperatures were the same throughout the building. In this study, a more realistic multi-zone scenario in a large building is proposed in the developing of the ANN temperature predictive model. The coupled effects between zones caused by the temperature difference are considered in the model. The results of a case study show that the new ANN model that considers the temperatures of the neighbouring zones, achieves more accurate results. The proposed modelling methodology can be extended to include other inputs, besides neighboring zones' temperatures, usage pattern of the building. So that the better intelligent control strategies can be developed for energy saving purposes, based on the more accurate predicted temperatures form the new model.

IEF-141* A NEW ZONE TEMPERATURE PREDICTIVE MODELLING FOR ENERGY SAVING IN BUILDINGS

Hao Huang , Lei Chen, Morteza Mohammadzaheri, Eric Hu

School of Mechanical Engineering, University of Adelaide, Australia

Currently in most buildings, the heating, ventilation and air conditioning (HVAC) systems are controlled by the present temperature in the building. If the predictions for future temperature in the building or a zone were available, the building management system (BMS) could use both present and future temperatures to control HVAC systems, then the energy consumed by HAVC systems could then be minimised. Therefore, a lot of research effort has been devoted to develop accurate temperature prediction models using various approaches, e.g. traditional thermodynamic, artificial neural networks (ANN), generic algorithms (GA) and fuzzy logic approaches. When the historical data of the building is available, the ANN approach is thought to be the most cost-effective method. Most of previous studies of ANN modelling of building temperature, have either focused on single-zone examination or assumed that zones' temperatures were the same throughout the building. In this study, a more realistic multi-zone scenario in a large building is proposed in the developing of the ANN temperature predictive model. The coupled effects between zones caused by the temperature difference are considered in the model. The results of a case study show that the new ANN model that considers the temperatures of the neighbouring zones, achieves more accurate results. The proposed modelling methodology can be extended to include other inputs, besides neighboring zones' temperatures, usage pattern of the building. So that the better intelligent control strategies can be developed for energy saving purposes, based on the more accurate predicted temperatures form the new model.

*Papers marked with * have been subject to full peer review.*

IEF-142* HEAT DISSIPATION USING MINIMUM COUNTER FLOW JET EJECTION DURING SPACECRAFT RE-ENTRY

Y. Zheng[a], N.A. Ahmed[a] and W. Zhang[b]

[a]Aerospace Engineering, School of Mechanical and Manufacturing Engineering,University of New South Wales, Australia [b]College of Aerospace and Materials Engineering National University of Defence Technology, China

A major problem of spacecraft re-entry is the extreme heat generated. Sink and ablation cooling are commonly used but the cost of building and implementing such heat protection systems is very high. The issue of heat dissipation has, therefore, been an extensive area of research. Various passive and active methods of flow control have been attempted. Unfortunately, no viable cost effective methodologies have yet been possible to develop. At the University of New South Wales, we have been exploring various methods of active flow control technologies for application to subsonic and supersonic flows with a bias towards higher efficiency and lower energy usage. In this paper, we have attempted a new approach of deploying minimum counter flow jet ejection as an active flow control method for heat dissipation. The concept relies on imparting sufficient momentum on the strong bow shock wave formed to induce oscillation but low enough to avoid instability during the flow interaction. To test the concept, an Apollo command module has been employed. It has been subjected to a free stream Mach number of 3 and a two-dimensional numerical flow simulation using ANSYS as the computational fluid dynamics tool has been performed for several cases of counter flow jet injection imparted on the bow shock wave formed and the interaction with the oncoming flow through the frontal stagnation point of the test module and compared with no injection case. Results obtained are highly promising. It appears that substantial heat reduction on the body is possible using the new approach. This finding may be of high practical significance and open up the possibility of developing a new thermal protective system using active flow control of dissipating and reducing heat during spacecraft re-entry with minimum energy input.

IEF-143* EFFECT OF THE RATIO OF SPECIFIC HEATS ON A SMALL SCALE SOLAR BRAYTON CYCLE

H. Riazi , N.A. Ahmed

School of Mechanical and Manufacturing Engineering, The University of New South Wales, Australia

Concentrated solar energy can be considered as the Brayton cycle's heat source since unlike conventional solar-thermal plants, which concentrate the sun's energy to generate steam for driving a turbine, the Brayton cycle does not use water. Instead, the concentrated solar energy is used to heat the gas, which is the working medium and then expands through a gas turbine to generate power. The major advantage of Brayton cycle is its potential for low operation and maintenance cost, and these engines are therefore considered for both small-scale and large-scale power applications. When the pressure losses occurring in the regenerative Brayton cycle are accounted for, the cycle efficiency depends on the ratio of specific heats of the working fluid, pressure loss coefficient and the ratio of minimum to maximum gas temperature. By utilizing a numerical analytic method, the efficiency characteristics of a regenerative closed Brayton cycle under the condition of different ratio of specific heats of the working fluids were studied at different working temperatures. Three different working fluids, namely, Helium, tetrafluoromethane (CF4 or Refrigerant-14, non-toxic and non-flammable) and air were analysed and compared for a small scale closed regenerative Brayton cycle which operates at a lower temperature that can be achieved easier by solar energy. It has been found that there exist an optimum thermal efficiency and its corresponding optimum compressor pressure ratio which varies for different working fluids. The influence of the ratio of specific heats and temperature ratio of the cycle the thermal efficiency of the cycle were investigated.

IEF-144* APPLICATION OF FLOW CONTROL TECHNIQUES FOR INDOOR VENTILATION

Chaofan Wu, Noor-E-Alam Ahmed

School of Mechanical and Manufacturing Engineering, Australia

Significant amount of energy is consumed each year on heating, ventilating and air conditioning (HVAC), raising ongoing demand for energy efficient HVAC systems. This study explores the applicability of flow control techniques to improve the ventilation performance of a mixed ventilated environment. The effect of two kind of periodic excitations, periodic air supply and synthetic jet, on the representative flowfield are investigated. The results show that the flow pattern becomes oscillatory and the fresh air sweeps a wider region by applying the periodic supply condition. The mean age of air is reduced as a consequence, indicating an improvement in the ventilation performance. By activating synthetic jet close to the air supply inlet, the ventilation air jet is vectored, showing the potential to more actively control the fresh air direction.

*Papers marked with * have been subject to full peer review.*

THE INTERNATIONAL ENERGY CONGRESS 17-18 SEPTEMBER 2012 EVOLVINGENERGY

IEF-145* OPTIMISING LOUVER LOCATION TO IMPROVE INDOOR THERMAL COMFORT BASED ON NATURAL VENTILATION

N.A. Ahmed, K. Wongpanyathaworn

School of Mechanical Engineering, The University of New South Wales, Australia

Energy usage in building accounts for more than a quarter of Australia's greenhouse gas emission with space cooling alone being responsible for more than 26% of the total electrical energy usage on extreme hot days. With the goal of achieving reduction in energy usage in buildings, natural ventilation is receiving greater attention and has become an increasingly important consideration of ventilating buildings on milder days. While not being able to replace active cooling or heating systems of air conditioning altogether, a greater understanding and improvements in natural ventilation analysis techniques can widen the ambient condition at which satisfactory thermal comfort can be achieved without using active cooling and heating systems. Traditionally, natural ventilation system has been designed based on guidelines and past experiences but without any means to measure the likely outcome prior to completion of the building. In this paper, we explore a method of determining indoor flow conditions based on statistical climate data, including temperature, wind direction and wind pressure. A case study was conducted on a medium sized double storey building with an adjoining atrium. Various natural ventilation opening configurations and sizes were investigated to find the most effective and economical design. It was found that, with optimal placement of the openings, the indoor temperature can be kept to within one degree Celsius above or below of the peak ambient temperature on a critical design day. The decrease in number of hours required from traditionally heating and cooling system and implications on savings in energy bills is also discussed.

IEF-146* NUMERICAL EVALUATION OF WIND DRIVEN VENTILATOR FOR ENHANCED INDOOR AIR QUALITY

Jason Lien, Noor Ahmed

School of Mechanical and Manufacturing Engineering, University of New South Wales, Australia

The present paper presents a numerical analysis of the difference in comfort level inside a room of a residential building when roof top turbine ventilator is installed. This analysis simulates various comfort factors which include the indoor air movement, room temperature, Predicted Mean Vote (PMV) and Predicted Percentage of Dissatisfied (PPD). Various test cases of ventilator exhaust rate were examined. The results showed that general comfort satisfying international standards in building can be achieved. This study also presents a qualitative and quantitative study of indoor air temperature and overall indoor air flow pattern. A promising conclusion that can be drawn from this study is that wind driven ventilators can play an important role in the design of a cost effective and energy efficient ventilation system inside a building.

IEF-147* CONTROL AND MANAGEMENT OF PARTICULATE EMISSIONS USING IMPROVED REVERSE PULSE-JET CLEANING SYSTEMS

Nicholas Findanis[a] and Noor E. Ahmed[b]

[a]Tyco Environmental Systems, Australia [b]The University of New South Wales, Australia

The control of particulate emissions from various applications such as power generation, cement plants, minerals processing etc. is essential to meet government regulatory standards. A common method used to clean filters in the extraction of particulate matter from a fluid stream, is Reverse Pulse-Jet (RPJ) cleaning systems. The operation of the RPJ cleaning system relies on stored energy in the form of compressed gas, which is usually air. In this paper, the design and application of an efficient cleaning system to minimise the use of compressed gas to achieve the required filter cleaning is described. In an RPJ cleaning system, a high-energy pulse of compressed gas is delivered into the filter medium to rapidly increase the internal pressure and, in the case of filter bags, accelerate the filter material to force the break-up of dust cakes that form on the filter surface. One key component of the cleaning system is an extremely fast acting valve that controls the flow of the high pressure gas, the other is the blowtube. The blowtube is a commercial steel pipe with a number of outlet orifices distributed along the longitudinal axis and centrally located above each filter. The cleaning system improvements have been achieved by advances in valve and blowtube design that have enabled increases in the peak pressures developed in the filters whilst minimising the response rate of the system to decrease the air consumption. The store of potential energy must be effectively and efficiently converted into kinetic energy to utilise the available energy to build pressure in the filter. Thus, by improving the RPJ cleaning system the operating costs associated with the compressors are reduced thereby reducing the environmental impact of operating filter cleaning systems, to more efficiently remove particulate matter from fluid streams.

*Papers marked with * have been subject to full peer review.*

IEF-148* INTEGRATION OF CARBONATION PROCESS WITH COAL FIRED POWER PLANT TO REDUCE CO2 EMISSIONS

S. Moazzem, M.G. Rasul and M.M.K. Khan

Power and Energy Engineering Research Group, School of Engineering and Built Environment, Central Queensland University, Australia

Global warming is a major issue for today's world due to continuous growth of greenhouse gas emissions. Carbon dioxide (CO2) is the major greenhouse gas which occupies approximately 55% of the total greenhouse gases. Coal fired power plants are one of the major contributors of CO2 emission. Different carbon capture and storage (CCS) technologies are available and some are being developed and implemented to minimise CO2 emission. Mineral carbonation technology is one of the CCS technologies where CO2 is sequestered as a solid environmentally safe stable carbonated product; however, carbonation process requires additional energy for pretreatment of the feed stocks (such as grinding of mineral) and compression of CO2 before carbonation. The main advantage of this technology is its exothermic reaction process. Heat energy required for pretreatment can be supplied from this exothermic reaction if heat energy can be recovered. Sensible heat from carbonated product can also be recovered from the carbonation process. This paper presents the feasibility of integrating carbonation technology with coal fired power plant. The results of its impact on power plant efficiency are presented and analyzed through thermodynamic energy balance.

IEF-149* FUZZY LOGIC BASED ENVIRONMENTAL INDICATOR FOR SUSTAINABILITY ASSESSMENT OF RENEWABLE ENERGY SYSTEM USING LIFE CYCLE ASSESSMENT

Gang Liu, A. Baniyounes, M.G. Rasul, M.T.O. Amanullah and M.M.K. Khan

Power & Energy Research Group, Central Queensland University, Australia

The use of renewable energy system (RES) is increasing rapidly. However, it is still difficult to measure the environmental impact of renewable energy system. This study aims to develop a general environmental indicator which is able to reflect all the aspects of environmental impacts of a RES. The life cycle assessment (LCA) and fuzzy logic is used to develop an environmental indicator to assess all the environmental impacts. The five important environmental indicators are selected based on LCA standard: Abiotic Depletion Potential, Land Use, Climate Change, Photochemical Ozone Creation Potential and Acidification Potential. Fuzzy inference system is used to convert the original values of these indicators into fuzzy data and aggregate them into the general indicator. The computed fuzzy value of the general indicator is then defuzzified into a crisp number as the final indicator value of environmental impacts.

IEF-150* HYBRID ENERGY SYSTEM FOR ST. MARTIN ISLAND, BANGLADESH: AN OPTIMIZED MODEL

A.K.M. Sadrul Islam[a], Md. Mustafizur Rahman[b], Md.Alam H. Mondal[c], Firoz Alamd

[a,b]Dept. of Mechanical and Chemical Engineering, Islamic University of Technology, Bangladesh [c]Energy Institute, AERE, Bangladesh Atomic Energy Commission, Bangladesh dSchool of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia

St. Martin's island is a small island in the Bay of Bengal about 9 km south of the main land of Bangladesh. Nearly 6000 inhabitants live there and fishing is their primary livelihood. Since the island is far away from the main land grid connection is almost impossible in terms of cost and geographic location. However, the electricity demand is partly fulfilled by stand alone diesel generators. In this study, an attempt has been made to model a hybrid electricity generation system for a small community of the island. This system incorporates a combination of solar PV, wind turbine, battery and diesel generator. HOMER software is used to analyze and find out the optimum configuration among a set of systems for electricity requirement for 100 households and 10 shops. The system must satisfy the requirements of 78 kWh/day primary load with 20 kW peak load. Sensitivity analysis is also done to see the impact of solar insolation, PV investment cost, wind speed and diesel fuel price on the optimum result. Solar PV (8 kWp), 2 wind turbines (3 kW) each, diesel generator (15 kW) and 25 batteries (800Ah each) hybrid system is found to be the best among all the configuration in terms of cost of electricity (COE).This configuration gives lowest COE Tk 26.54 / kWh (US$ 0.345/kWh) and total net present cost (NPC) of Tk 10,620,388 (USD$ 137,927) with a renewable fraction of 31%. This system can reduce CO2 emission by about14 tons per year compared to diesel generator only.

*Papers marked with * have been subject to full peer review.*

THE INTERNATIONAL ENERGY CONGRESS 17-18 SEPTEMBER 2012 EVOLVINGENERGY

IEF-151* DESIGN AND MODELING OF A GREENHOUSE FOR A REMOTE REGION IN NEPAL

Seona Candy[a], Graham Moore[a], Peter Freere[b]

[a]Department of Infrastructure Engineering, The University of Melbourne, Australia
[b]World Vision Australia, Burwood Victoria, Australia

Food insecurity arises in circumstances where individuals or families cannot meet their most basic need for food. This problem is particularly common in remote mountain areas where the shortage of arable land and a harsh climate make it impossible to produce a sufficient quantity and diversity of food throughout the year. This investigation forms part of a project to improve food security using solar technology in Humla, an impoverished mountain region in Nepal. In similar locations, increased food production and preservation have been achieved using solar greenhouses and dryers. However, a systematic approach, where these technologies are used in a complementary way to supply the shortfall in food and address nutritional deficiencies has not been attempted. This paper describes the selection, construction and testing of an existing greenhouse design in Humla. An initial design selection was devised that was based on existing high altitude greenhouses but modified to incorporate locally available materials. A TRNSYS model was then created and validated from measured data. The model has then been used to explore methods to improve the performance and reduce costs of the basic design and further adapt it to the local climate.

IEF-152* DESIGN OF A DYNAMIC CONTROL SYSTEM FOR STANDALONE SOLAR-HYDROGEN POWER GENERATION

Xin Xu Dou, John Andrews

School of Aerospace Mechanical and Manufacturing Engineering, RMIT University, Australia

Solar-hydrogen systems employing a photovoltaic array and storage of surplus energy in the form of hydrogen are an attractive zero-emission and low-maintenance solution for remote areas and other standalone power supplies to replace diesel and PV- battery systems. A number of experimental and demonstration solar-hydrogen systems have been constructed and tested, but little work has been done to date on an overall control unit for such systems. The present paper thus focuses on the design of a control unit for a solar-hydrogen system with hydrogen generation via a proton exchange membrane (PEM) electrolyser, compressed gas or metal-hydride hydrogen storage, and a PEM fuel cell. Particular emphasis is placed on the design of an integrated maximum power point tracker and load splitter that can dynamically supply power to meet the load and divert any surplus to operate the PEM electrolyser and produce hydrogen for storage. Two alternative algorithms for the execution of the load splitting function are outlined. Measurements of the typical variation of solar radiation over a very short time scale, together with typical household load variations, are used to suggest an appropriate unit time interval within which the system operates at selected optimal settings. The main components of a planned experimental program to measure the performance of the control unit for a small standalone solar PV-hydrogen system are presented.

IEF-153* AN ENERGY SAVING APPROACH IN THE MANUFACTURE OF CARBONATED SOFT DRINK BOTTLES

Fugen Daver and Bilal Demirel

School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia

The use of plastics for packaging has been increasing steadily over the years. Polyethylene terephthalate (PET) dominates the carbonated soft drinks (CSDs) market as the main material used in this application due to its toughness, clarity and superior barrier properties. Currently, the CSD bottles constitute 40% of the global PET consumption. PET bottles demonstrate favourable life cycle inventories compared to alternative packaging materials such as aluminium and glass. Manufacturing of the bottles starts with the production of PET resin from petrochemicals. The PET resin is then melted and injected into a preform mould which has the shape of a test tube with a threaded neck. Subsequently, the preform is heated to a certain temperature, and stretched and blown simultaneously to take up the shape of the bottle mould. Each of these steps requires energy. In this study, we will focus on the environmental footprint of CSD bottles and demonstrate that light-weighting of CSD bottles through a new bottle/preform design brings about energy reduction and greenhouse gas savings.

*Papers marked with * have been subject to full peer review.*

IEF-154*	DEVELOPMENT OF A WIND TUNNEL TEST FACILITY TO SIMULATE THE EFFECT OF RAIN ON ROOF VENTILATION SYSTEMS AND ENVIRONMENTAL MEASURING DEVICES

T. G. Flynn[a], G. Behfarshad[b] and N. A. Ahmed[c]

[a]Aerodynamics Laboratory, School of Mechanical and Manufacturing Engineering, University of New South Wales, Australia
[b]Department of Mechanical Engineering at the University of British Columbia, Canada
[c]School of Mechanical and Manufacturing Engineering, University of New South Wales, Australia

Roof top wind driven ventilators are deceptively simple in appearance and are cheap to manufacture and easy to install and costs nothing to operate. But the flow associated with its operation is very complex. It accepts air in an axial direction and expels along with the air extracted from inside a building in a vertical direction. The wind driven ventilator is subjected to the vagaries of nature, such as high temperature and rain. While the effects of wind and temperature can be experimentally investigated using conventional wind tunnels, the effect of rain is difficult to ascertain. However, such roof ventilation systems and environmental measuring devices have a problem of moisture ingress, with the potential of system inefficiency or failure in the extreme case. Consequently, the design and development of a new test facility in the form of rain chamber or test section was undertaken. To reduce cost and optimise greater usage of resources, it was decided to make the test facility compatible for operation with a conventional wind tunnel. The open jet wind tunnel in the Aerodynamics Laboratory of the University of New South Wales was selected as the most suitable for the incorporation of the new wind tunnel test section to simulate the effects of rain on roof ventilation systems and other environmental measuring devices, such as Pitot probes. Successful tests were carried out to confirm the suitability new test section through velocity profile measurement with a purpose built water spray delivery system. Testing of two different types of roof ventilator was carried out to test for ventilator water ingress performance. Although limited in scope, the testing showed interesting features associated with the operation of the roof ventilators in different weather conditions and confirmed the benefits of new test section.

IEF-155*	THE ROLE OF MICRO HYDRO POWER SYSTEMS IN REMOTE RURAL ELECTRIFICATION: A CASE STUDY IN THE BAWAN VALLEY, BORNEO

Sari Murni[a], Jonathan Whale[a], Tania Urmee[a], John Davis[a], David Harries[b]

[a]Murdoch University, Australia
[b]The University of Western Australia, Australia

Like communities all over the world, the people of the Bawan Valley in the East Kalimantan Province of Indonesian Borneo want the benefits of electricity. The Bawan Valley, however, is geographically isolated from the rest of East Kalimantan, making access to electricity via the national electricity grid impossible. Hydro resources are abundant in the Bawan Valley and hydroelectricity is a promising option for electrification of remote villages in this area. The existing micro hydro systems in the area have been built as government, community-based or private agency projects. Some of these micro hydro systems have been more successful than others. This paper presents the results of a study of two micro hydro systems in the Bawan Valley villages of Liang Butan and Tang Paye. The study aimed to provide insight into critical issues in the stages of development and the impacts of a micro hydro system on rural communities in the Bawan Valley. Surveys of the villages included field observations, written questionnaires, energy audits and semi-structured interviews with community leaders and householders. Various key informants, such as village headmen, Kepala Adat (grass roots community leader), and micro hydro equipment manufacturers were also interviewed. The key findings of the study were that the success of micro hydro systems depends not only on technical aspects, such as design and operation and maintenance, but also on social factors such as community capacity building, and that the successful implementation of micro hydro systems in remote areas requires careful planning and the involvement of all stakeholders in the planning process.

*Papers marked with * have been subject to full peer review.*

THE INTERNATIONAL ENERGY CONGRESS 17-18 SEPTEMBER 2012 EVOLVINGENERGY

IEF-156*	REVIEW OF WIND ENERGY UTILISATION IN SOUTH ASIA

Iftekhar Khan[a] , Harun Chowdhury[a], Roesfiansjah Rasjidin[a], Firoz Alam[a], Tazul Islamb, and Sadrul Islamc

[a]School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia [b]Department of Mechanical Engineering, Chittagong University of Engineering and Technology, Bangladesh
[c]Department of Mechanical and Chemical Engineering, Islamic University of Technology, Bangladesh

Due to huge population and economic growth, the demand for power and energy is increasing rapidly in most Asian countries especially in India, Bangladesh and Pakistan where the power generation is based mainly on fossil fuel. Power generation from renewable energy sources especially wind energy has not been well utilised in South Asia. In comparison, European countries and countries in North America have made significant progress in wind energy utilisation for power generation. Scant information on utilisation of renewable energy for power generation in Bangladesh, Pakistan and India is currently available in the public domain. Therefore, the primary objective of this study is to undertake a comparative analysis of wind energy utilisation for power generation in South Asian countries. The analysis includes current power generation by fuel types and the government initiatives and policies on wind energy utilisation. The study indicates that India is significantly ahead in wind energy utilisation compared to other two countries Bangladesh and Pakistan. The main obstacle for utilising wind energy is the lack of clear policy and government initiatives. However, all three countries have ambitious plans for wind energy utilisation in the future.

IEF-157*	A SYSTEM DYNAMICS CONCEPTUAL MODEL ON RETAIL ELECTRICITY SUPPLY AND DEMAND SYSTEM TO MINIMIZE RETAILER'S COST IN EASTERN AUSTRALIA

Roesfiansjah Rasjidin, Arun Kumar, Firoz Alam, Iftekhar Khan, Shougi Abosuliman

School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia

In eastern Australia's electricity market, the retailers have to purchase a certain amount of power to fulfill their customers' demand. When the purchased power through forward contracts exceeds the electricity demanded by customers it leads to retailer's loss. On the other hand, the demand is higher than the purchased power which urges the company to buy extra power from a peaking power generator at electricity market with volatile price. This research studies power supply and demand systems at electricity retail market. System Dynamics (SD) methodology is used to investigate the influence of weather and forward contract conditions on the fluctuation of energy supply and demand in order to minimize energy retailer's cost. A respective conceptual model has been built by using qualitative phase in SD approach which enables further development in the SD's quantitative phase.

IEF-158*	EXPANDER MODELLING IN BINARY CYCLE UTILIZING GEOTHERMAL RESOURCES FOR GENERATING GREEN ENERGY IN VICTORIA, AUSTRALIA

M.Oreijah , As. Date, A. Date, M. Bryson, A. Akbarzadeh

School of Aerospace, Mechanical & Manufacturing Engineering, RMIT University, Australia

This paper investigates the computational modeling of a binary organic Rankine power cycle. The computer model has been generated to aid the design and manufacture of apparatus that will be utilized during experimentation on the geothermal resources in Victoria, Australia. A review of Australia's geothermal prospects is also presented here. Suitable technology to utilize the low grade heat from the available geo-fluids has been explained to connect the recent technology with the new approached design. The paper involves the design of the heat engine with the reaction turbine. In addition, theoretical analysis and performance predictions have been presented briefly in the paper to compare between different diameters for the reaction turbine in the organic Rankine cycle engine with power and efficiency. In this paper, realistic recommendations will be discussed to the best of the geothermal energy as sustainable energy resources to be useful for achieving the Australian target. The binary cycle is modeled to evaluate the output power and the efficiency. A computer model for binary cycle is presented in this paper. Thermal-mechanical energy conversion efficiency is predicted using the computer modeling and presented in the analysis.

*Papers marked with * have been subject to full peer review.*

IEF-159 RENEWABLE ENERGY EDUCATION AT UNSW

Richard Corkish, Stephen Bremner, Anna Bruce, Gavin Conibeer, Hanzheng Duo, Evatt Hawkes, Bany Jaya, Merlinde Kay, Alison Lennon, Ivan Perez-Wurfl, Alistair Sproul, Ted Spooner, Santosh Shrestha, Geoff Stapleton, Ashraf Uddin, Muriel Watt, Darcy Wentworth

School of Photovoltaic & Renewable Energy Engineering University of NSW, Australia

The University of New South Wales has carried out silicon solar cell device research since the mid 1970s. The UNSW solar cell research group has, since 2000, pioneered specialised undergraduate education in photovoltaics engineering. That research and teaching is now included in the School of Photovoltaic and Renewable Energy Engineering, formed in 2006. The Photovoltaics and Solar Energy Engineering undergraduate program is an almost unique four year undergraduate program covering device theory, photovoltaic technology, manufacturing, system design and applications, policy, analysis and modelling. The Renewable Energy Engineering undergraduate program encompasses a broader range of energy efficiency and renewable energy technologies, particularly wind, solar thermal and biomass. Both can be combined with degrees in Science, Commerce, Arts or Laws. The School also offers postgraduate coursework programs and Masters and PhD research programs. The School has also developed modules for teachers and students for photovoltaics education at senior high school level. The School had 641 students enrolled in its programs in the first semester of 2011, including 472 undergraduate students, 98 postgraduate coursework students and 71 research students. The school is strongly engaged with the Asian growth centres, including with Chinese universities, having formal education agreements with seven. These arrangements were initially supported financially by the Australian Government through the Asia-Pacific Partnership for Clean Development and Climate (APP) program. Articulation arrangements have been agreed for three Singapore polytechnics so that students will be able to transfer to UNSW following graduation from the recently developed clean energy diploma programs. Three of the School's text books have been published in Chinese scripts and one will be published in Korean too.

IEF-160 OPTIMISATION OF DUAL-PURPOSE SOLAR AMMONIA-WATER ABSORPTION HEAT PUMP

Yuebin Zhao[a], Robert Taylor[a], Alistair Sproul[b], Françoise Burgun[c], Andrew Tanner[d]

[a]School of Mechanical and Manufacturing Engineering
[b]School of Photovoltaic and Renewable Energy Engineering University of New South Wales, Sydney, NSW 2052, Australia
[c]CEA INES RDI - French National Institute for Solar Energy, Le Bourget-du-Lac, Rhône-Alpes, France [d]Chromasun Pty Ltd, San Jose, CA, USA

As a clean and renewable source, solar energy has always been an attractive alternative energy due to its abundance and various usages. Both cooling and heating effect can be obtained from the sun. In hospitals, hotels, university buildings, etc. heating and cooling are both needed all year round. However, conventional solar thermal products are designed to provide either heating or cooling which do not satisfy this dual demand and, in general, have relatively low coefficient of performance (COP). Previous work has shown that conventional solar cooling technology (i.e. photovoltics paired with an efficient vapor compression system) is a better investment today because of superior COP efficiency although this gap may close within ~15 years (Otanicar et al., 2012). In order to overcome this problem, a dual-purpose solar thermal driven heat pump is developed to harness the "free" cooling or heating of the conventional heat pump. In addition, a concentrating solar thermal collector is used in order to obtain the high temperatures required to run an ammonia-water absorption heat pump with a heating COP of 1.6 and a cooling COP of 0.6. Transient simulation analysis for this system using the TRNSYS numerical modeling environment is used to optimize the system design for various Australia locations. Further a simple economic and environmental assessment of this dual-purpose system is presented to demonstrate the feasibility of this concept.

*Papers marked with * have been subject to full peer review.*

THE INTERNATIONAL ENERGY CONGRESS 17-18 SEPTEMBER 2012 EVOLVINGENERGY

IEF-161* MANUFACTURE, QUALIFICATION AND APPROVAL OF NEW AVIATION TURBINE FUELS AND ADDITIVES

Ulas Yildirim[a] and Sylvester Abanteriba[b]

[a]Joint Fuels and Lubricants Agency, Royal Australian Air Force, Australia
[b]School of Aerospace, Mechanical and Manufacturing, RMIT University, Australia

rld energy consumption has increased 17 fold in the last century and emissions of CO2, CO, SO2 and NOx from fossil fuel combustion are the main causes of atmospheric pollution. Worldwide petroleum reserves are expected to be depleted in less than 50 years at the present rate of consumption. In 2008, the estimated fossil fuel consumption rate was approximately 90 million barrels per day. Commercial aviation is contributing around 2-3% of global carbon emissions. Since the approval of the use of Fischer Tropsch Hydroprocessed Synthesized Paraffinic Kerosenes (SPK) produced by Sasol as a blending stock in DEFSTAN 91-91 research has been ongoing to introduce feedstock from alternative feedstock using different methods. However, use of alternative fuels in aviation presents greater restrictions for any candidate fuel. Biofuels industries in countries such as Australia are still in their infancy. There appears to be efforts to grow this industry; however currently, there does not appear to be any direction providing guidance on how to manufacture and carry out certification activities for aviation biofuels. The aim of this paper is to review and provide a guideline in the production and certification of aviation biofuels.

IEF-162* THERMAL PERFORMANCE MODELLING OF RESIDENTIAL HOUSE WALL SYSTEMS

Fayez Aldawi[a,b], Firoz Alam[a], Hazim Moria[a,b], Mohammed Alghamdi[b]

[a]RMIT University,School of Aerospace, Mechanical and Manufacturing, Australia
[b]Yunbu Industrial College, Mechanical Engineering Department, Kingdom of Saudi Arabia

The energy consumption in residential house sectors contributes enormously to the greenhouse gas emission and soaring energy bills. Energy efficient residential house envelopes can reduce our dependency on fossil fuel and environmental pollution. It is difficult to achieve high energy savings for ongoing heating and cooling with currently used mainstream residential house envelopes. A new energy smart house wall system is required to achieve energy conservation. Therefore the main objective of this study is to investigate the thermal performance of a new house wall envelope and compare its performance with a conventional house envelope. The study was undertaken for several climate zones encompassing all major cities in Australia. The finding indicates that a considerable energy saving can be achieved using the new house wall system.

IEF-163* EXPERIMENTAL AND COMPUTATIONAL STUDY OF A MICRO VERTICAL AXIS WIND TURBINE

Abdulkadir Ali[a], Steve Golde[b], Firoz Alam[a], and Hazim Moria[a]

[a]School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Melbourne, Australia
[b]Wind Energy Technology Pty Ltd, Australia

With recent surge in fossil fuel prices and demand for cleaner renewable energy sources, wind turbines have become an alternative technology for power generation. Greenhouse gases such as carbon dioxide emitted into the atmosphere contribute to the global climate change. This paper investigates the design of a Savonius type vertical axis wind turbine and its potential to generate power. To enhance the performance of the turbine, a flow restricting cowl is incorporated into the turbine. The airflow behavior of the turbine was investigated both experimentally and computationally. Three different configurations were studied (open position, centred position and a closed position). It is found that a partially cowled turbine in a centred and closed position resulted in a better performance of the turbine than a fully cowled turbine with the same configuration.

*Papers marked with * have been subject to full peer review.*

IEF-164*	STATUS OF POWER GENERATION BY DOMESTIC SCALE WIND TURBINES IN AUSTRALIA

Firoz Alam[a], Abdulkadir Ali[a], Iftekhar Khan[a], Saleh Mobin[b]

[a]School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia
[b]Department of Higher Education Primary Industries, Northern Melbourne Institute of TAFE (NMIT), Australia

The world's fossil fuel energy resources are diminishing at a faster rate and most importantly the liquid fossil fuel is expected to be finished by 2060s. Moreover, the fossil fuel is directly related to air pollution, land and water degradation. The danger of climate change due to global warming caused by greenhouse gas emissions compels the policy makers, scientists and researchers globally to explore power generation from renewable sources such as wind. Despite significant progresses have been made in power generation using large scale wind turbines recently, domestic scale wind turbines that have immense potentials for standalone power generation are not explored and adequately researched. Therefore, the primary objective of this study is to review and analyse the potentials for power generation by domestic scale wind turbines for the residential and semi-commercial applications. The study reviews the current status of wind characteristics in built-up areas, economic feasibility, aerodynamic and technological limits, local government planning requirement, local and foreign small scale wind turbine manufacturers.

IEF-165*	BIOFUEL FROM ALGAE- A REVIEW

Firoz Alam[a], Abhijit Date[a], Saleh Mobin[b] and Sadiqul Awal[b]

[a]School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia [b]Depatment of Higher Education Primary Industries, Northern Melbourne Institute of TAFE (NMIT), Australia

Fossil based fuel energy resources are depleting rapidly and most importantly the liquid fossil fuel will be diminished by the middle of this century. In addition, the fossil fuel is directly related to air pollution, land and water degradation. In these circumstances, biofuel production from renewable sources can relieve partly our dependency on fossil fuel and assist to maintain the healthy global environment and economic sustainability. Production of biofuel from food stock generally consumed by humans or animals can be problematic and the root cause of worldwide dissatisfaction. Therefore, microalgae can be an ideal biofuel feedstock thanks to their rapid growth rate, greenhouse gas fixation ability (net zero emission balance) and high production capacity of lipids as microalgae do not compete with our food or feed crops. Moreover, they can be grown on non-arable land and saline water. Therefore, the primary objective of this study is to review the current body of knowledge in biofuel production from algae. In this study, an overview of microalgae uses for biodiesel and bioethanol production, including their cultivation, harvesting, and processing is presented. The most used microalgal species as well as major microalgal cultivation systems (photobioreactors and open ponds) are also discussed. The chemical processes for the break down of the oily secretions into biodiesel are also elaborated.

IEF-166*	EXPERIMENTAL ANALYSIS OF TWO-PHASE FLOW NOZZLE FOR DESALINATION AND POWER GENERATION SYSTEM

Sara Vahaji, Abhijit Date, Aliakbar Akbarzadeh

Energy Conservation and Renewable Energy Group, School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Australia

This paper presents theoretical and experimental performance analysis for two-phase flow nozzle. Governing equations have been discussed with the performance predictions for different inlet temperatures and outlet pressures. Different size nozzles have been tested for varying inlet and outlet conditions. The experimental results have shown that for simple nozzle geometry (orifice) the expansion is far away from a complete isentropic expansion. Reaction force measurements for an ideal condition (i.e. isentropic expansion) and real condition are compared and discussed.

*Papers marked with * have been subject to full peer review.*

AUTHOR INDEX

RMIT UNIVERSITY

Platinum Sponsor

Curtin University

Silver Sponsor

RMIT UNIVERSITY
Platform Technologies
Research Institute

RMIT UNIVERSITY
School of Aerospace, Mechanical
and Manufacturing Engineering

BOSCH
Invented for life

iSyst
INTELLIGENTE SYSTEME GMBH

Congress Sponsors

ecogeneration

Media Partner

EVOLVING ENERGY

The IEF International Energy Congress

17–18 September 2012
Sydney Convention and Exhibition Centre
Sydney, Australia

Professor Sylvester Abanteriba
Chair
International Energy Foundation
124 La Trobe Street
Melbourne VIC 3001
AUSTRALIA

International Energy Foundation