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# ENERGY and ENVIRONMENT III



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Proceedings of the 3rd IASME / WSEAS  
International Conference on ENERGY & ENVIRONMENT  
(EE '08)

University of Cambridge, Cambridge, UK,  
February 23-25, 2008

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A Series of Reference Books and Textbooks



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## **Preface**

This book contains proceedings of the 3rd IASME / WSEAS International Conference on ENERGY & ENVIRONMENT (EE'08) which was held in University of Cambridge, Cambridge, UK, February 23-25, 2008. The first EE conference was held in Chalkis, Greece in 2006.

The World Conference of IASME and WSEAS on ENERGY and ENVIRONMENT is the internationally recognized Forum for the dissemination of the latest advances on Energy Systems, Renewable Energy, Power Systems, Electric Energy etc as well as their impact and their interaction with other areas of Environmental Engineering, Civil Engineering, Chemical Engineering, Mechanical Engineering, Electrical Engineering and Applied Physics. The various WSEAS conferences on Energy has been successfully held each year since 2001 and has produced more than 30 volumes of Proceedings while the best papers and the invited papers after extension and after peer review from 4 international referees, are published in WSEAS Journals covered by all the major scientific indexes.

The 3rd IASME/WSEAS International Conference on ENERGY and ENVIRONMENT aims to disseminate the latest research and applications in the aforementioned fields. The range of topics covered are listed on the Call For Papers. The friendliness and openness of the WSEAS conferences, adds to their ability to grow by constantly attracting young researchers.

The IASME/WSEAS International Conference on ENERGY and ENVIRONMENT attracts each year a large number of well-established and leading researchers in the aforementioned areas as well as Modern and Advanced Applications in our Real Life.

The meetings have always had a special appeal to young researchers and are characterized by a friendly atmosphere in which delegates at different stages of their careers can talk to each other. Scientists within all the areas of Energy Technologies, Environmental Science and Engineering will benefit from attending the meeting. As a conclusion, the conference offers to the engineers and scientists a unique forum for establishing new collaborations within present or upcoming research projects, exchanging useful ideas, presenting recent research results, participating in discussions and establishing new academic collaborations, linking university with the industry.

Expanded and enhanced versions of papers published in these conference proceedings are also going to be considered for possible publication in one of the WSEAS journals that participate in the major International Scientific Indices (Elsevier, Scopus, EI, Compendex, INSPEC, CSA .... see: [www.worldses.org/indexes](http://www.worldses.org/indexes) ) these papers must be of high-quality (break-through work) and a new round of a very strict review will follow. (No additional fee will be required for the publication of the extended version in a journal).

We cordially thank all the people of WSEAS for their efforts to maintain the high scientific level of conferences, proceedings and journals.

The Editors



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## Plenary Lecture 1

### Exergy as a Tool for Sustainability



**Professor Marc A. Rosen**

Founding Dean

Faculty of Engineering and Applied Science

University of Ontario Institute of Technology

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also: President-Elect, Engineering Institute of Canada

**Abstract:** We conventionally use energy-based efficiency measures to assess how well energy systems perform. Energy-based measures of merit, however, do not really indicate how nearly performance efficiency approaches the ideal. In fact, energy measures can lead to confusion and, in some instances, to wrong decisions and wasteful allocations of resources. Exergy analysis, which is based on the second law of thermodynamics, avoids the difficulties associated with energy methods, and allows efficiencies to be clearly understood and measures to improve efficiency to be properly assessed. In addition, exergy provides insights into environmental impact and ecology, as well as economics. When all facets of exergy methods are viewed together, exergy is seen to provide an extremely useful tool for understanding, assessing and achieving sustainability, within energy and other systems. In this presentation, the exergy concept and its application as an analysis and improvement tool, and its impact on efforts to achieve sustainability, are described. Various examples are used to illustrate the benefits of exergy.

**Brief Biography of the Speaker:** Dr. Marc A. Rosen, P.Eng. is Professor and founding Dean of the Faculty of Engineering and Applied Science at the University of Ontario Institute of Technology in Oshawa, Canada. He is also President-elect of the Engineering Institute of Canada and has served as President of the Canadian Society for Mechanical Engineering.

With over 50 research grants and contracts and 400 technical publications, Dr. Rosen is an active teacher and researcher in thermodynamics, energy technology (including cogeneration, district energy, thermal storage and renewable energy), and the environmental impact of energy and industrial systems. Much of his research has been carried out for industry, and Dr. Rosen has also worked for such organizations as Imatra Power Company in Finland, Argonne National Laboratory near Chicago, and the Institute for Hydrogen Systems near Toronto. Dr. Rosen has received numerous awards and honours, and is a Fellow of the Engineering Institute of Canada, the Canadian Academy of Engineering, the Canadian Society for Mechanical Engineering, the American Society of Mechanical Engineers and the International Energy Foundation.

## Plenary Lecture 2

### Minimum Energy for an Improved Environment: Electrical Machine Design and Control for the Future



**Professor Roy Perryman**

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**Professor Stephen Dodds**

Professor of Control Engineering,  
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**Abstract:** This paper presents a vision for the future design of electrical machines and the systems in which they are employed with a view to achieving a contribution to the overall energy consumption minimisation throughout industry. For example, developments in rare earth magnetic materials have enabled new designs of high power density, high efficiency machines. Computationally demanding design techniques such as finite elements and genetic algorithms are becoming practicable with advances in software and digital processors. This is enabling the progress of more sophisticated machine designs with special rotor and stator geometries yielding optimal flux paths, high torque and minimal ripple outputs. To achieve the aforementioned energy consumption minimisation, not only is the electrical machine design important but also the consideration of the energy losses in the systems employing the electrical machines. Automatic control will play an increasingly important role in this regard. Optimal control strategies, especially those involving nonlinearities, are of an open loop structure and hitherto have been largely of academic interest in view of their sensitivities to parametric errors and external disturbances. Advances in easily attained computational power, however, are enabling practicable closed loop versions of these optimal controls that overcome these limitations to be created, with the aid of artificial intelligence. This paper includes several applications in which combined electrical machine design for maximum efficiency and system design for minimum energy usage is of paramount importance.

**Brief biography of the speakers:** Roy Perryman graduated with a BSc(Hons) in Electrical Engineering in 1969 and gained a PhD in Magnetic Materials in 1974. He spent 17 years in the electrical and electronics industry working with AFA Minerva (EMI) Ltd, Bowthorpe Controls, and Walter Jones & Co Ltd. In 1988 he joined the University of Greenwich and became Associate Head of the School of Engineering. He was subsequently appointed as Head of the School of Electrical & Manufacturing Engineering at the University of East London in 1996 and became Ford Professor in Engineering Education in 2004. He is a Chartered Engineer and Fellow of the Institution of Engineering and Technology (FIET). His research interests are in the design and control of electrical machines and drive systems, magnetic materials, condition monitoring and the application of neural networks.

Stephen Dodds received a BSc (Hons) in Electrical Engineering in 1967, an MSc in Systems Engineering in 1970 and a PhD in the Control of Flexible Spacecraft in 1985. He spent 13 years as an attitude and orbit control systems engineer on European space programmes and originated new digitally implemented spacecraft attitude control. In 1985 he was appointed Reader in Control Engineering at the University of East London (UEL) and subsequently expanded his control systems research to encompass electrical drives. In 1997 he was made an Academician of the Academy of Non-linear Sciences of Russia and became Professor of Control Engineering at UEL.

## Plenary Lecture 3

### Worldwide Energy Demand and Environmental Safeguard



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**Abstract:** The great increase in the world's population along with the improvement in life standards of poorer countries will imply a rapidly growing energy demand in the next few decades. Possible scenarios foresee an increase of as much as 100% in global energy demand from the present to 2050, mainly concentrated in Asian countries as China, India, Indonesia, and in southern Africa. In this situation, there will be two main challenges to face: on the one hand, to find and ensure the energy resources necessary to support both the continuing growth of industrialised countries, and the rising demands of developing countries; on the other hand, to mitigate the already occurring climate changes and assure environment safeguard. In order to meet these crucial requirements, innovation and new technologies will play a fundamental role in our future. New, enlightened policies can effectively establish important opportunities for countries willing to face the challenge. From this point of view, Germany and Spain have already undertaken the path of renewable energy since a few years ago; the UK has recently announced the development of a new, important research project aimed at CO<sub>2</sub> reduction. Moreover, both the European Union and the U.S.A. have recently enacted a number of directives that clearly point in this direction. As regards this global competition, the present lecture will mainly discuss the combined role of the following topics: the development of renewable energy sources, the efficiency in energy end-uses, and frontier technologies in electric power engineering. In this context, emphasis will be given also to smart-grids and distributed generation for an innovative, effective and comprehensive system of electric energy production and distribution.

**Brief biography of the speaker:** Francesco Muzi is a professor of Power Systems at the University of L'Aquila, Italy, where he has also the scientific responsibility for the Power System Group. His main research interests concern Power systems transients and dynamics, Power quality in distribution systems, Power system reliability, Electromagnetic analysis, and Power systems diagnostics and protection. In these fields, he authored or co-authored over 100 scientific papers published in reviewed journals or presented at international conferences.

For his contribution on Lightning Induced Overvoltages, he received a mention in the book of P. Chowdhuri "Electromagnetic Transients in Power Systems", John Wiley & Sons, New York and participated to the outline of the "IEEE Guide for improving the lightning performance of electric lines", IEEE Standards Department, New York. He has also a patent for an industrial invention, namely "Power system controlled by a microprocessor".

He is a regional chairman of the Italian National Lighting Society and was a chairman or keynote lecturer in a number of international conferences organized by ISSAT (International Society of Science and Applied Technologies) and WSEAS.

He is a technical reviewer for the following international journals: IEEE Transactions on Power Delivery, Electric Power Systems Research by Elsevier Science, IET Generation, Transmission & Distribution.



## Plenary Lecture 4

### The Methanol Fuel of Latter Petroleum Era



**Professor Wu Yuji**

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**Abstract:** What I am going to talk about is the methanol fuel of latter petroleum era. The latter petroleum era is coming, the environmental problems is growing, the department of sci-tech, energy, environmental protection in the world even the United Nations and Governments of many countries in the world are highly concerned about oil clean alternative energy, All kinds of alternative energy is also competing for the replacable right.

In the face of this situation, this article will elucidate the view of “Only methanol fuel is the most perfect fuel in the early of latter petroleum era through scientific data analyses.

**Brief biography of the Speaker:** Wu Yuji, Professor, senior engineer, he is the vice chairman of China Small-Medium Enterprise Association, vice executive director of Small-Medium Enterprise Committee in China Petrochemical Industry Association , vice chairman of China Alcohol Ether Fuel and Alcohol Ether Clean Automobile Special Interest Committee, a researcher of China Administration Section Institute Academic Committee, president of China Luohe Petrochemical Group Holding CO.,LTD., president of China Zhongyou Energy Technology CO.,LTD., famous expert on alcohol ether fuel in China, “the father of china methanol fuel”, “the founder of china large-percentage alcohol ether fuel ”.

## Plenary Lecture 5

### Chemistry of non-precipitation components of wet atmospheric pollutant deposition with Poland as an example



**Professor Zaneta Polkowska**

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**Abstract:** Except of dry and precipitation induced wet deposition, there also exist other pathways of atmospheric pollutants flux into the ground. These are different kinds of atmospheric deposits in the form of hydrometeors, which do not belong to precipitation category, such as: dew, hoarfrost, rime and liquid fog deposit. Due to the fact that such hydrometeors are formed within near-ground layer of air, where emission takes place, the observed pollutant concentrations are significantly higher than those typical for atmospheric precipitation. In this paper the results of monitoring of atmospheric deposits chemistry in some selected sites in Poland during the period between 2004 and 2007 are presented. The average total ionic content (TIC) of dew, hoarfrost, liquid fog and rime was 219, 283, 110 and 105 meq/l respectively, while typical TIC value for precipitation was 37 meq/l. In all types of atmospheric deposits different ions play an important role:  $\text{Ca}^{2+}$  and  $\text{SO}_4^{2-}$  in dew,  $\text{NH}_4^+$  and  $\text{SO}_4^{2-}$  in rime,  $\text{Na}^+$  and  $\text{Cl}^-$  in hoarfrost,  $\text{NO}_3^-$  in fog. Acidic ( $\text{pH} < 5.0$ ) and strongly acidic ( $\text{pH} < 4.0$ ) atmospheric deposits, such as rime and fog, were observed only in the mountainous regions. The average equivalent ratio of  $\text{Cl}^-/\text{Na}^+$  for hoarfrost, rime and fog samples was apparently close to the seawater value, whereas for dew ones in all stations this ratio was significantly higher in comparison with seawater. Very high values were observed for dew samples collected in urban inland and coastal stations, where the concentration level of  $\text{Cl}^-$  was 3 to 4 times higher than  $\text{Na}^+$ . The higher contribution of sodium ions (in comparison with chloride ions) was reported only in dew samples collected at rural inland stations. The  $\text{NO}_3^-/\text{SO}_4^{2-}$  ratio in hoarfrost, rime and dew samples ranges over a wide interval, but in general concentration of  $\text{SO}_4^{2-}$  is higher than  $\text{NO}_3^-$ . Only in fog samples, the average values of this ratio are close to 1, what means, that  $\text{NO}_3^-$  and  $\text{SO}_4^{2-}$  ions are on the similar concentration level in this type of atmospheric deposit. The lowest values of  $\text{nss-SO}_4^{2-}/\text{SO}_4^{2-}$  and  $\text{nss-Ca}^{2+}/\text{Ca}^{2+}$  were observed only in hoarfrost and rime in lowland urban station localized close to the Baltic coast, because of high contribution of  $\text{SO}_4^{2-}$  and  $\text{Ca}^{2+}$  originated from sea-salts. When you take into account both concentration and volume of deposited water, dew and hoarfrost become a significant component of wet deposition over the lowland part of the territory of Poland, responsible for additional 50-75% deposited pollutants when compared with the precipitation itself. In the mountains of southern Poland, fog deposition in the form of rime and liquid deposit tend to be more important pathway than dew and hoarfrost. At numerous high elevated and well exposed sites pollutant deposition via fog droplets even exceeds deposition via precipitation, which leads to destructive environmental results, particularly in mountain forest ecosystems.

**Brief Biography of the Speakers:** Dr eng. Zaneta Polkowska is a researcher in Department of Analytical Chemistry, Chemical Faculty, Gdansk University of Technology, Gdansk, Poland; specialist in modern analytical techniques applied for determination of atmospheric pollutants (used in environmental protection). Nowadays, her main interests are : the presence of pollutants and their concentration levels in atmospheric precipitation and runoff waters in relation to the prevailing meteorological conditions.

Dr Mieczyslaw Sobik is a researcher in Department of Meteorology and Climatology, University of Wroclaw, Poland; specialist in mountain climatology and deposition processes of atmospheric pollutants. His main interest is the role of fog on water balance and pollutant deposition in mountain forest ecosystems of Central Europe.

## Plenary Lecture 6

### Solar Energy and the Global Warming



**Professor Vassilis Gekas**

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**Abstract:** The Sun, our Sun, is our main source of energy. But Sun has also the sunspots. Energy is the light side of the Sun-planet interaction, the shadow is a bi-effect, sometimes called entropy, it is the negative aspect of this energy which Sun sends to our planet. The world sees nowadays an increasing global warming period which in its turn has been attributed to heliogenic and/or anthropogenic effects. The cyclic nature of the influence of Sun on earths climate is discussed. Also the expected Sun activity maximum of the year 2012 and further NASA forecasts for the coming years until the end of the 25th Sun cycle are presented and discussed. We show that the cycles of Nature are the most important but also that the anthropogenic effects could damage the sensitive balance which is the outcome of the interplay between the natural forces and Man, a balance which was kept in the long history of the mankind, but now in the last decades is seriously threatened.

**Brief biography of the Speaker:** MSc Chemical Engineer NTUA Athens 1971, PhD Food Engineering, Lund , 1987, Sweden. Vassilis Gekas is Professor of Transport Phenomena and Director of the Transport Phenomena & Environmental Thermodynamics at the Technical University of Crete. He gained international reputation in the Membrane Technology both the synthetic and biological membranes. Author of the CRC edited book of "Transport Phenomena of Foods and Biological Materials " , Boca Raton FL, 1992. Author of several books in Greek. He was the first to be chairman of the Environmental Engineering dpt , 1984- 2003. He deals with teaching and research in the following fields: Renewal energy sources, desertification, unit operations with developing of Greek raw materials , recovery of high added value constituents from agro-food wastes, enzymatic conversion of starch, thermal treatment of solid wastes, solar cooling. His approximately 50 publications in international journals gained the attention of approximately 1000 colleagues (CI=1000).

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