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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



# Table of Contents

<b>Plenary Lecture 1: Exergy as a Tool for Sustainability</b> <i>Marc A. Rosen</i>	13
<b>Plenary Lecture 2: Minimum Energy for an Improved Environment: Electrical Machine Design and Control for the Future</b> <i>Roy Perryman, Stephen Dodds</i>	14
<b>Plenary Lecture 3: Worldwide Energy Demand and Environmental Safeguard</b> <i>Francesco Muzi</i>	15
<b>Plenary Lecture 4: The Methanol Fuel of Latter Petroleum Era</b> <i>Wu Yuji</i>	16
<b>Plenary Lecture 5: Chemistry of non-precipitation components of wet atmospheric pollutant deposition with Poland as an example</b> <i>Zaneta Polkowska, Mieczyslaw Sobik</i>	17
<b>Plenary Lecture 6: Solar Energy and the Global Warming</b> <i>Vassilis Gekas</i>	19
<b>Part 1: Energy</b>	
<b>Solar Absorption Refrigeration System using New Working Fluid Pairs</b> <i>Jasim M. Abdulateef, Kamaruzzaman Sopian, M. A. Alghoul, Mohd Yusof Sulaiman, Azami Zaharim, Ibrahim Ahmad</i>	23
<b>Factors Decomposition of Energy Intensity: the case of Liaoning province</b> <i>He Yong-Xiu, Tao Wei-Jun, Li Yan, Zhang Song-Lei, Li Fu-Rong</i>	29
<b>Computational analysis of heat and water transfer in a PEM Fuel Cell</b> <i>Ebrahim Afshari, Seyed Ali Jazayeri</i>	35
<b>Investigation of Energy-efficient 10 KVA Switchable Transformer</b> <i>Sam. Ali, Jin. Liu</i>	41
<b>Photocatalytic degradation of phenol in aqueous phase with TiO<sub>2</sub> immobilized on three different supports with a simple method</b> <i>S. N. Hosseini, M. Borghei, M. Vossoughi, N. Taghavinia</i>	46
<b>Measurement of Spray Characteristics of Coaxial Jet Spray Flames under High Pressure</b> <i>Mariko Nakamura, Seung-Min Hwang, Yoshinori Nakao, Daichi Nishioka, Jun Hayashi, Fumiteru Akamatsu</i>	51
<b>Performance Assessment and Improvement of an Existing Air Conditioning System of a Supermarket: A Case Study on Bi-Lo Supermarket</b> <i>M. Hansen, M. G. Rasul</i>	55
<b>Energy Efficiency in Croatian Residential and Service Sector – Analysis of Potentials, Barriers and Policy Instruments</b> <i>Vesna Bukarica, Zeljko Tomsic</i>	61
<b>Energy Conservation and Power Consumption Analysis in China Based on Input-output Method</b> <i>He Yong-Xiu, Zhang Song-Lei, Tao Wei-Jun, Li Fu-Rong</i>	67
<b>Thermal Analysis of Nickel/Metal (Ni/MH) Hydride Battery during Charge Cycle</b> <i>Nabi Jahantigh, Ebrahim Afshari</i>	73



<b>Energy Saving Opportunities through Heat Recovery from Cement Processing Kilns: A Case Study</b>	79
<i>I. Al-Hinti, A. Al-Ghandoor, A. Al-Naji, M. Abu-Khashabeh, M. Joudeh, M. Al-Hattab</i>	
<b>Effect of demand-side management on the feasibility of highperformance windows</b>	84
<i>U. Atikol, Hossein Assefi, M. Reza Azizian, Maryam Gharebaghi</i>	
<b>Exergy as a Tool for Sustainability</b>	90
<i>Marc A. Rosen</i>	
<b>Heat Exchanger Exergoeconomic Lifecycle Cost Optimization</b>	99
<i>Liaquat Ali Khan, Ali El-Ghalban</i>	
<b>Assessing Challenges in Developing Sustainable Adaptation Strategies by Considering Climate Changes</b>	107
<i>S. M. Mofidi, A. M. Moradi, M. Akhtarkavan, H. Akhtarkavan</i>	
<b>Several Test Results on Earthing-Resistance-Estimation Instrument</b>	113
<i>Hitoshi Kijima</i>	
<b>Energy Conservation Opportunity by the Use of Aerogel Nanomaterials in Steam Pipes</b>	118
<i>Sourena Sattari, Roghayeh Lotfi, Vahideh Baharmast</i>	
<b>Feasibility of a Hybrid Cooling System in a Thermal Power Plant</b>	124
<i>C. R. Williams, M. G. Rasul</i>	
<b>Structural, energy and environmental aspects in Iranian oil refineries</b>	130
<i>Sourena Sattari, Akram Avami</i>	
<b>A Concise Review of Exergy-Based Economic Methods</b>	136
<i>Marc A. Rosen</i>	
<b>Assessing Sustainable Adaptation of Historical Buildings to Climate Changes of Iran</b>	145
<i>S. M. Mofidi, A. M. Moradi, M. Akhtarkavan</i>	
<b>Analysis of Ultimate Energy Consumption by Sector in Islamic Republic of Iran</b>	151
<i>B. Farahmandpour, I. Nasserri, H. Hourri Jafari</i>	
<b>Slip Flow Irreversibility Effects and Conjugate Heat Transfer in a Counterflow Heated Microchannel</b>	158
<i>E. O. B. Ogedengbe, G. F. Naterer, M. A. Rosen</i>	
<b>Energy-Conscious and Sustainable Architectural Principles for Cold Environments</b>	165
<i>S. M. Mofidi</i>	
<b>Part 2: Environment</b>	
<b>Minimum Energy Forced Dynamic Position Control of PMSM Drives</b>	173
<i>Stephen J. Dodds, Gunaratnam Sooriyakumar, Roy Perryman</i>	
<b>Predicting, controlling and damping inter-area mode oscillations in Power Systems including Wind Parks</b>	180
<i>P. Ledesma, C. Gallardo</i>	
<b>Optimal Renewable Energetic System Placement Based on Local Microclimate</b>	186
<i>Emil Pop, Monica Leba, Camelia Tabacaru Barbu, Livia Buzdugan</i>	
<b>Energy Conservation Measures in an Institutional Building by Dynamic Simulation Using DesignBuilder</b>	192

*M. M. Rahman, M. G. Rasul, M. M. K. Khan*

<b>Characterization of Energy Production and Health Impact in Romanian context</b> <i>Diana Mariana Cocarta, Adrian Badea, Tiberiu Apostol</i>	198
<b>Screening of Options for VOC Emissions Reductions in Manufacturing Office Furniture Partitions</b> <i>Frank S. LUISSEr, Marc A. Rosen</i>	204
<b>Environmental Effects of Irregular Extracting of Gravel from River Beds</b> <i>Siamak Boudaghpour, Seyyed Arman Hashemi Monfared</i>	213
<b>Operating Reserves Provided by Distributed Generation</b> <i>Francisco D. Moya Ch., Duvier Bedoya Bedoya, Gilberto De Martino Jannuzzi, Luiz Carlos Pereira Da Silva</i>	219
<b>A Fast Method for Frequency Response Calculation in Under Frequency Load Shedding Scheme</b> <i>Abolfazl Salami, Hamid Abdi</i>	225
<b>A scenario reducing the risks of returning earthquakes in Adapazari</b> <i>Taeke M. De Jong</i>	229
<b>Biodiversity and health taken as the basic problems in GuiYang</b> <i>Taeke M. De Jong</i>	235
<b>SmartGrids and distributed generation: the future electricity networks of the European Union</b> <i>Francesco Muzi</i>	243
<b>The analysis of precipitation variation and quantiles in Iran</b> <i>Pari Sima Katiraie Boroujerdy</i>	248
<b>Simulation of Concentration Distributions of Primary Gaseous Pollutants Using Air Quality Modeling System in Bang Pakong Area, Thailand</b> <i>Chatchawan Vongmahadlek, Meigen Zhang, Boonsong Satayopas, Pham Thi Bich Thao</i>	254
<b>Process analyses and monitoring system in Labview Data Logging and Supervisory Control Module of the cryogenic pilot plant for tritium removal</b> <i>Carmen Maria Moraru, Iuliana Stefan, Ovidiu Balteanu, Ciprian Bucur, Liviu Stefan, Anisia Bornea, Ioan Stefanescu</i>	260
<b>Volatile Organic Compounds Monitoring in Southern Kuwait</b> <i>A. A. Ramadan, M. Al-Sudairawi</i>	264
<b>Three dimensional blade to blade flow</b> <i>Derek Payne, Vasos Pavlika</i>	270
<b>Chemical And Physical Property Of Rice Straw Waste And Hospital Sewage Sludge In Turned Windrow Aeration System</b> <i>Khajornsak Sopajaree, Apisit Sancom</i>	276
<b>Zero emissions systems in the food processing industry</b> <i>Uyen Nguyen Ngoc, Hans Schnitzer</i>	284
<b>Environmental perspective in Iran's energy consumption sectors</b> <i>Akram Avami, Bahare Farahmandpour</i>	293
<b>Geometry of Branching Biological Structures</b> <i>Ioanna Paraskaki, Minas Voulgaridis, Vassilis Gekas</i>	298
<b>Reuse Building Materials</b> <i>Davorin Kralj, Mirko Markic</i>	303

<b>Simulation of Steam Unit Start up by Combustion Units</b>	307
<i>Abolfazl Salami, Shahram Jadid</i>	
<b>An Inventory of Primary Gaseous Emissions from Thailand with Spatial and Temporal Allocation Profile</b>	313
<i>Chatchawan Vongmahadlek, Pham Thi Bich Thao, Boonsong Satayopas, Narisara Thongboonchu</i>	
<b>Novel Strategy for Compensating Current Determination in Single Phase Active Power Filters</b>	319
<i>W. Hosny, B. Dobrucky</i>	
<b>Grid Computing Technology Enhances Electrical Power Systems Implementations</b>	324
<i>R. Al-Khannak, B. Bitzer</i>	
<b>Using A New Grid Model For Prediction Of Photochemical Oxidants Formation And Dispersion</b>	330
<i>E. Fatehifar, A. Alizadeh Osalu, M. A. Kaynejad, A. Elkamel</i>	
<b>The contribution of asynchronous loads to pollutant and greenhouse gas emissions</b>	336
<i>Francesco Muzi, Luigi Passacantando</i>	
<b>Using real-time loss management to improve the operating efficiency of power distribution systems</b>	341
<i>Stefano D'Ottavi, Francesco Muzi</i>	
<b>Estimation of Partial Discharge Inception Voltages due to Voids in Power Cables</b>	345
<i>M. U. Zuberi, A. Masood, M. F. Khan, Ekram Husain, A. Anwar</i>	
<b>Chemistry of non-precipitation components of wet deposition with Poland as an example</b>	349
<i>Saneta Polkowska, Mieczyslaw Sobik</i>	
<b>Natural and Human Impact on Pollutant Deposition in Mountain Ecosystems with the Sudetes as an Example</b>	355
<i>Mieczyslaw Sobik, Marek Blas</i>	
<b>Surge Over-Voltage Protection For Substations</b>	360
<i>Mohamed Adel Abdallah</i>	
<b>Supervisory control using EIB – KONNEX technology: A sensor network protocol enabling a holistic and environmental approach in architecture</b>	365
<i>John K. Sakellaris</i>	
<b>Thermal Modelling for Permanent Magnet Synchronous Motors</b>	379
<i>Roy Perryman, Gunaratnam Sooriyakumar, Stephen J.Dodd Sooriyakumar</i>	
<b>The Evaluation of performances of installations by power plants from Romania concerning professional risks</b>	386
<i>Aurica Suvergel, Alice Raducanu, Angela Stanca</i>	
<b>Impact Evaluation of Electrical Equipments on Human Health</b>	392
<i>Alice Raducanu, Aurica Suvergel, Angela Stanca, Marin Stefan, Cornelia Marcolt, Corneliu Neagu</i>	
<b>Floristic Diversity, Composition and Richness in Relation to Topography of a Hill Dipterocarp Forest in Malaysia</b>	398
<i>I. Saiful, I. Faridah-Hanum, J. Kamaruzaman, A. Latiff</i>	
<b>Optimal Placement Of Facts Devices</b>	407
<i>S. Durairaj, B. Fox</i>	
<b>An Ex Ante Evaluation Of Sustainable Development: The Case Of “Kolubara” Mining Basin</b>	412
<i>Slavka Zekovic, Miodrag Vujosevic</i>	

<b>IKONOS Sensing Data for Estimating Cabbage Production in Cameron Highlands, Malaysia</b> <i>Kamaruzaman Jusoff</i>	421
<b>On applying the systemic thought in environmental economics: Greek economy trends until 2030 based on a model proposed by the Nobel laureate W. Leontief incorporating environmental indicators</b> <i>John K. Sakellaris, Nikolaos A. Mylonas</i>	424
<b>Drive Systems in Underground Metro Saving Energy</b> <i>Cornelia Aida Bulucea, Doru Adrian Nicola, Andreea Brandusa, Constantin Brandusa</i>	433
<b>Environmental Protection in Malaysia with Sustainable Forest Management Practices</b> <i>Dato' Hj. Dahlan Hj. Taha, Hj. Kamaruzaman Jusoff</i>	439
<b>Part 3: Renewable Energy Sources</b>	
<b>Doubly-Fed Induction Generator Torque in Wind Turbines</b> <i>Jurica Smajo, Dinko Vukadinovic</i>	451
<b>Design and Simulation of a Small Scale Solar Powered Desalination System</b> <i>J. R. Schrader, M. G. Rasul</i>	457
<b>Development of Renewable Energy in European Union</b> <i>Andreea Zamfir</i>	464
<b>Electric Energy Savings and Light Guides</b> <i>Jitka Mohelnikova</i>	470
<b>Energy efficiency assessment of an aeolic plant installation in the Livorno harbour: a station vs. model comparison</b> <i>C. Busillo, F. Calastrini, G. Gualtieri, B. Gozzini</i>	474
<b>Effects of Blade Configurations on Flow Distribution and Power Output of a Zephyr Vertical Axis Wind Turbine</b> <i>J. O. Ajedegba, G. F. Naterer, M. A. Rosen, E. Tsang</i>	480
<b>Preliminary Life Cycle Assessment of Nuclear-Based Hydrogen Production Using Thermochemical Water Decomposition</b> <i>Luthfi I. Lubis, Ibrahim Dincer, Marc A. Rosen</i>	487
<b>Solar Powered Unitized Regenerative Fuel Cell System</b> <i>Salwan S.Dihrab, Kamaruzzaman Sopian, Nowshad Amin, M. M.Alghoul, Azami Zaharim</i>	495
<b>Optimization of Renewable Energy Hybrid System by Minimizing Excess Capacity</b> <i>Juhari Ab. Razak, Kamaruzzaman Sopian, Yusoff Ali, Mohammad Ahmed Alghoul, Azami Zaharim, Ibrahim Ahmad</i>	500
<b>Sizing of Isolated Wind-Electrolyzer Systems by use of a Probabilistic Method</b> <i>Terje Gjengedal, Lars Nesje Grimsmo, Magnus Korpaas</i>	505
<b>Potential of Power Generation from a Wind Energy Conversion System in Malaysian Coastal Area</b> <i>M. Z. Ibrahim, R. Zailan</i>	512
<b>Residential photovoltaic energetic system, optimized with an FPGA based control unit</b> <i>Lucian Milea, Marin Dragulinescu, Orest Oltu, Monica Dascalu, Marius Stoian</i>	518
<b>Fixed And Variable Speed Induction Generators For Real Power Loss Minimization</b> <i>S. Durairaj, D. Flynn, B. Fox</i>	523

<b>Solar Radiation Maps From Satellite Data For A Tropical Environment – Case Study Of Malaysia</b> <i>Ayu Wazira Azhari, Kamaruzzaman Sopian, Azami Zaharim, Mohamad Al Ghouf</i>	528
<b>Evaluation Of 1D And 2D Texturing Of Monocrystalline Solar Cell</b> <i>F. Jahanshah, K. Sopian, I. Ahmad, M. Y. Othman, Azami Zaharim, S. H. Zaidi</i>	534
<b>Parametric Analysis of multipurpose solar adsorption system- cooling and heating</b> <i>M. A. Alghoul, M. Y. Sulaiman, K. Sopian, B. Z. Azmi, M. Abd. Wahab, A. Zaharim</i>	538

## 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



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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).

**Authors Index**

Abdallah, M. A.	360	Dascalu, M.	518	Li, Y.	29
Abdi, H.	225	De Jong, T. M.	229, 235	Liu, J.	41
Abdulateef, J. M.	23	Dihrab, S. S.	495	Loffi, R.	118
Abu-Khashabeh, M.	79	Dincer, I.	487	Lubis, L. I.	487
Afshari, E.	35, 73	Dobrucký, B.	319	Luisser, F. S.	204
Ahmad, I.	23, 500, 534	Dodds, S.	14, 173, 379	Marcolt, C.	392
Ajedegba, J. O.	480	D'Ottavi, S.	341	Markic, M.	303
Akamatsu, F.	51	Dragulinescu, M.	518	Masood, A.	345
Akhtarkavan, H.	107	Durairaj, S.	407, 523	Milea, L.	518
Akhtarkavan, M.	107, 145	El-Ghalban, A.	99	Mofidi, S. M.	107, 145, 165
Al-Ghandoor, A.	79	Elkamel, A.	330	Mohelnikova, J.	470
Alghoul, M. A.	23, 495, 500 528, 538	Farahmandpour, B.	151, 293	Monfared, S. A. H.	213
Al-Hattab, M.	79	Faridah-Hanum, I.	398	Moradi, A. M.	107, 145
Al-Hinti, I.	79	Fatehifar, E.	330	Moraru, C. M.	260
Ali, S.	41	Flynn, D.	523	Moya Ch., F. D.	219
Ali, Y.	500	Fox, B.	407, 523	Muzi, F.	15, 243 336, 341
Alizadeh Osalu, A.	330	Gallardo, C.	180	Mylonas, N. A.	424
Al-Khannak, R.	324	Gekas, V.	19, 298	Nakamura, M.	51
Al-Naji, A.	79	Gharebaghi, M.	84	Nakao, Y.	51
Al-Sudairawi, M.	264	Gjengedal, T.	505	Nasser, I.	151
Amin, N.	495	Gozzini, B.	474	Naterer, G. F.	158, 480
Anwar, A.	345	Grimsmo, L. N.	505	Neagu, C.	392
Apostol, T.	198	Gualtieri, G.	474	Ngoc, U. N.	284
Assefi, H.	84	Hansen, M.	55	Nicola, D. A.	433
Atikol, U.	84	Hayashi, J.	51	Nishioka, D.	51
Avami, A.	130, 293	He, Y.-X.	29, 67	Ogedengbe, E. O. B.	158
Azhari, A. W.	528	Hosny, W.	319	Oltu, O.	518
Azizian, M. R.	84	Hosseini, S. N.	46	Othman, M. Y.	534
Azmi, B. Z.	538	Husain, E.	345	Paraskaki, I.	298
Badea, A.	198	Hwang, S.-M.	51	Passacantando, L.	336
Baharmast, V.	118	Ibrahim, M. Z.	512	Pavlika, V.	270
Balteanu, O.	260	Jadid, S.	307	Payne, D.	270
Barbu, C. T.	186	Jafari, H. H.	151	Perryman, R.	14, 173, 379
Bedoya, D. B.	219	Jahanshah, F.	534	Polkowska, S.	17, 349
Bitzer, B.	324	Jahantigh, N.	73	Pop, E.	186
Blas, M.	355	Jannuzzi, G. D. M.	219	Raducanu, A.	386, 392
Borghei, M.	46	Jazayeri, S. A.	35	Rahman, M. M.	192
Bornea, A.	260	Joudeh, M.	79	Ramadan, A. A.	264
Boroujerdy, P. S. K.	248	Jusoff, K.	421, 439	Rasul, M. G.	55, 124 192, 457
Boudaghpour, S.	213	Kamaruzaman, J.	398	Razak, J. A.	500
Brandusa, A.	433	Kaynejad, M. A.	330	Rosen, M. A.	13, 90, 136 158, 204 480, 487
Brandusa, C.	433	Khan, L. A.	99	Saiful, I.	398
Bucur, C.	260	Khan, M. F.	345	Sakellaris, J. K.	365, 424
Bukarica, V.	61	Khan, M. M. K.	192	Salami, A.	225, 307
Bulucea, C. A.	433	Kijima, H.	113	Sancom, A.	276
Busillo, C.	474	Korpaas, M.	505	Satayopas, B.	254, 313
Buzdugan, L.	186	Kralj, D.	303	Sattari, S.	118, 130
Calastrini, F.	474	Latiff, A.	398		
Cocarta, D. M.	198	Leba, M.	186		
Da Silva, L. C. P.	219	Ledesma, P.	180		
		Li, F.-R.	29, 67		

Schnitzer, H.	284	Sulaiman, M. Y.	23, 538	Wahab, M. A.	538
Schrader, J. R.	457	Suvergel, A.	386, 392	Williams, C. R.	124
Smajo, J.	451	Taghavinia, N.	46	Yuji, W.	16
Sobik, M.	17, 349, 355	Taha, D.	439	Zaharim, A.	23, 495, 500
Sooriyakumar, G.	173, 379	Tao, W.-J.	29, 67		528, 534, 538
Sopajaree, K.	276	Thao, P. T. B.	254, 313	Zaidi, S. H.	534
Sopian, K.	23, 495, 500	Thongboonchu, N.	313	Zailan, R.	512
	528, 534, 538	Tomsic, Z.	61	Zamfir, A.	464
Stanca, A.	386, 392	Tsang, E.	480	Zekovic, S.	412
Stefan, I.	260	Vongmahadlek, C.	254, 313	Zhang, M.	254
Stefan, L.	260	Vossoughi, M.	46	Zhang, S.-L.	29, 67
Stefan, M.	392	Voulgaridis, M.	298	Zuberi, M. U.	345
Stefanescu, I.	260	Vujosevic, M.	412		
Stoian, M.	518	Vukadinovic, D.	451		