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Table of Contents

Plenary Lecture 1: Solar Air Conditioning for an Institutional Building in Subtropical Climate	12
Mohammad G. Rasul	
Plenary Lecture 2: Current Status of Renewable Energy Technology Options	13
Mohammad Alghoul	
Plenary Lecture 3: Energy Efficient Ventilating Residential Buildings	14
Teet-Andrus Koiv	
Plenary Lecture 4: Large Scale Solar Assisted Hot Water Heating Systems for Green Hospital	15
Kamaruzzaman Sopian	
Design and Analysis of Wavelength Selective Wide Acceptance Angle Holographic Concentrator	17
for PV Application Abhiiit Ghosh R Ranian A K Nirala H I. Yaday	
110 ngu Ghosh, 1. 1. 1. ngun, 11. 11. 11. 11. 12. 14447	
Conceptual Design of Wave Buoy Legged Spider Power Device	21
A. Priyanto, A. Maimun, M. Zamani, Jaswar, A. S. A. Kader	
Improvement the Performance of a Direct Evaporative Cooler using the Liquid Desiccant	27
Dehumidification Concept	
Abdulrahman Th. Mohammad, Sohif Bin Mat, M. Y. Sulaiman, K. Sopian, Abduljalil A. Al-Abidi	
Experimental Investigation of Melting in Triplex Tube Thermal Energy Storage	33
Abduljalil A. Al-Abidi, Sohif Mat, K. Sopian, M. Y. Sulaiman, Abdulrahman Th. Mohammad	
The Study of Thermoelectric Module with Various Thermal Conditions of Exhaust Gas from	39
Diesel Engine	
Byungdeok In, Kihyung Lee	
Experimental Investigation of a Solar Desiccant Cooling System	46
Arfidian Rachman, Zuraini Mohd. Enggsa,Sohif Mat, Kamaruzzaman Sopian	
Optimization of Processing Parameters of Holographic Concentrator for Maximum Efficiency	50
Operation in PV System	
R. Ranjan, Abhijit Ghosh, A. K. Nirala, H. L. Yadav	
Power Prediction Analysis using Artificial Neural Network in MS Excel	54
Nurhashinmah Mahamad, Muhamad Kamal B. Mohammed Amin	
Comparison of CFD Simulation on Tray Dryer System Between Porous and Solid Product	59
Suhaimi Misha, Sohif Mat, Mohd Hafidz Ruslan, Kamaruzzaman Sopian, Elias Salleh	
Technology Review of Solar Assisted Heat Pump System for Hot Water Production	65
Mohamed Azly Abdul Aziz , Sohif Mat, Kamaruzzaman Sopian	

Experimental Investigation of Solar Hybrid Desiccant Air-Conditioning System Using Heat Pipe Heat Exchanger	76
Zuraini Mohd Enggsa, Arfidian Rachman, M. Mehdi, Sohif Mat, Kamaruzzaman Sopian	
Evaluation of Surface Photovoltage (SPV) in Al-Back Surface Fields Bifacial Solar Cell Suhaila Sepeai, Saleem H. Zaidi, S. L. Cheow, M. Y. Sulaiman, K. Sopian, A. W. Azhari, N. A. Ludin, M. Khairunaz	81
Initial Investigation on Movable-Fins Vertical Axis Wind Turbine Willy Tjiu, Sohif Mat, Tjukup Marnoto, Mohd Hafidz Ruslan, Kamaruzzaman Sopian	84
Comparison Simulation between Ventilation and Recirculation of Solar Desiccant Cooling System by TRNSYS in Hot and Humid Area MMS Dezfouli, Sohif Mat, K. Sopian	89
Modeling and Simulation of Pico-Hydro Power Plant. Case Study in Southern Carpathians Camelia Barbu, Adrian Dinoiu, Petre Vamvu	94
Modeling and Simulation of Wind Turbines in Southern Carpathians Adrian Dinoiu, Camelia Barbu, Maria Pop	100
Equipment Designed to Control a Heating Hybrid System with Solid Fuel Boiler and Solar Panels Brana Liliana Samoila, Marius Daniel Marcu, Florin Gabriel Popescu	106
Evaluation of Drying Chili by Two Methods: Solar Assisted Heat Pump Dryer and Open Sun Drying MMS Dezfouli, Sohif Mat, Mohd Hafidz Ruslan, Kamaruzzaman Sopian	112
Photovoltaic Thermal (PV/T) Water Collector Experiment Study Goh Li Jin, Mohd Yusof Hj Othman, Hafidz Ruslan, Kamaruzzaman Sopian	117
Low-Concentration Output Power Enhancement from Photovoltaic Panels Ivan Adidharma Audwinto, Chan Hoy Yen, K. Sopian, Saleem H.Zaidi	125
The Performance of External Shading Devices and Daylighting Rule of Thumb for a Tropical Climate Muhamad Fadle Mohamad Abu Sadin, Nik Lukman Nik Ibrahim, Kamaruzzaman Sopian	130
Parametric Study on Water Based Photovoltaic Thermal Collector M. A. M. Rosli, S. Mat, M. H. Ruslan, K. Sopian	135
Prospect and Future of Solar Dryer for Agricultural and Marine Product: Perspective Malaysia Ahmad Fudholi, Mohd Yusof Othman, Mohd Hafidz Ruslan, Sohif Mat, Kamaruzzaman Sopian	141
Thermal Comfort and Indoor Air Quality Evaluation of Hospital Patient Ward in Malaysia F. Azizpour, S. Moghimi, E. Salleh, S.Mat, C.H.Lim, K. Sopian	150
Structural, Optical and Electrical Properties of In Doped CdS Thin Films Prepared from Co- Sputtering Technique M. A. Islam, M. S. Hossain, M. M. Aliyu, Yusuf Sulaiman, T. Razykov, K. Sopian, N. Amin	155

Large Scale Solar Assisted Hot Water Heating Systems invested at Green Hospital Poorya Ooshaksaraei, Kamaruzzaman Sopian	161
<u>An Investigation of Front Surface Field, Emitter and Base Doping Concentration on p-type</u> <u>Screen Printed Back Contact Solar Cells</u> <i>M. K. Mat Desa, S. A. Shahahmadi, Suhaila Sepeai, K. Sopian, M. Y. Sulaiman, Saleem H. Zaidi</i>	166
Energy Saving and Emission Reduction by Applying Radiant Barrier Insulation on External Wall Layers, Case Study of Large Scale Medical Center in Malaysia S. Moghimi, F. Azizpour, E. Salleh, C. H. Lim, S. Mat, K. Sopian	170
The Prospects of a Promising Solar Thermal Concentrator (Fresnel Lens) for Cooking, Heating and Electricity Generation <i>Abdukkarim Hamza El-Ladan, Chan Hoy Yen, Mohd Hafidz Ruslan, Kamaruzzaman Sopian, Saleem</i> <i>Hussain Zaidi</i>	175
Smart Appliance Scheduling Scheme for Smart Meters using Adaptive Particle Swarm Optimization Mohd. Moniruzzaman, Kamaruzzaman Sopian, Saleem H. Zaidi	181
Experimental Performance of Water-Filled Heat Pipe-Heat Exchanger Ebrahim Alfegi, Alhadi Abosbaia, Khaled Mezughi, M. A. Alghoul, K. Sopian	187
Effect of Dust on Photovoltaic Performance: Review and Research Status Zeki Ahmed, Hussein A Kazem, K. Sopian	193
Parametric Study for Savonius Vertical Axis Marine Current Turbine using CFD Simulation Omar Yaakob, M. Arif Ismail, Yasser M. Ahmed	200
<u>An Overview of the Key Components in the Pico Hydro Power Generation System</u> Mohd Farriz Basar, Masjuri Musa Othman	206
<u>Characteristics of Lightweight Concrete Filled with Palm-Based Polyurethane</u> Kamarul Aini Mohd Sari, Sohif Mat, Khairiah Haji Badri, Muhammad Fauzi Mohd Zain	214
Using Computational Fluid Dynamics (CFD) Method in Analyzing Different Design Configurations of Venturi-Shaped Wind-Induced Natural Ventilation Towers C. H. Lim, Omidreza Saadatian, M. Yusof Sulaiman, Sohif Mat, K. Sopian, Mohd. Razali Mahyuddin, K. C. Ng	219
Numerical Modeling of Silicon/Germanium (Si/Ge) Superlattice Solar Cells Ahmad Aizan Zulkefle, Maslan Zainon, Zaihasraf Zakaria, Kamaruzzaman Sopian, Nowshad Amin	233
<u>R&D of Advanced Solar Dryers in Malaysia: (1) Air Based Solar Collectors</u> Kamaruzzaman Sopian, Ahmad Fudholi, Mohd Yusof Othman, Mohd Hafidz Ruslan, Sohif Mat	238
R&D of Advanced Solar Dryers in Malaysia: (2) Water Based Solar Collectors Kamaruzzaman Sopian, Ahmad Fudholi, Mohd Yusof Othman, Mohd Hafidz Ruslan, Sohif Mat	247
Absorption Spectrum of N719 and SQ1 Dye on TiO2 Surface of Dye-Sensitized Solar Cell N. Ahmad-Ludin, N. Abdul-Karim, M. A. Mat-Teridi, M. A. Ibrahim, S. Sepeai, K. Sopian, M. Y. Sulaiman, Nilofar Asim	255

Current Financing Models and Issues in the Malaysian Green Technology Projects N. Ahmad-Ludin, N. H. Hamid, M.A. Mohd-Bakria, M.A Mat-Teridi, S. Sapeai, M. A. Ibrahim, K. Sopian, S. Mat, C. Siwar	259
Engine Performance and Economic Impact Study of Diesel-Like Tire Pyrolysis Oil C. Wongkhorsub, N. Chindaprasert, S. Peanprasit	267
Mathematical Modelling of Solar Drying of Thin Layer Ginger Ahmad Fudholi, Mohd Hafidz Ruslan, Mohd Yusof Othman, Azami Zaharim, Kamaruzzaman Sopian	273
Mathematical Model of Double-Pass Solar Air Collector Ahmad Fudholi, Mohd Hafidz Ruslan, Mohd Yusof Othman, Kamaruzzaman Sopian	279
Prediction the Outlet Temperature of Finned Double-Pass Solar Air Collector Ahmad Fudholi, Mohd Hafidz Ruslan, Mohd Yusof Othman, Kamaruzzaman Sopian	284
Mathematical Modeling for the Drying Curves of Turmeric Ahmad Fudholi, Norfazlina Mohd Ariffin, Mohd Hafidz Ruslan, Mohd Yusof Othman, Kamaruzzaman Sopian	290
Energy Consumption of Hybrid Solar Drying System (HSDS) with Rotating Rack for Salted Silver Jewfish Ahmad Fudholi, Mohd Hafidz Ruslan, Mohd Yusof Othman, Kamaruzzaman Sopian	294
Drying Curve Modelling of Salted Silver Jewfish under Open and Solar Drying Ahmad Fudholi, Mohd Hafidz Ruslan, Mohd Yusof Othman, Azami Zaharim, Kamaruzzaman Sopian	299
Design of PV-"Single Phase Grid" Electric Vehicle Charging System Fadhil Yousif, M. A. Alghoul, Ebrahim Alfegi, Nilofar Asim, K. Sopian	304
Simulation of Hybrid PV-"3 Phase Grid" Electric Vehicle Charging System Fadhil Yousif, M. A. Alghoul, Ebrahim Alfegi, Nilofar Asim, K. Sopian	310
Stability Study of Alkyl Monolayers Directly Attached to Si (111) Surface for Solar Cells Application Mohd Adib Ibrahim, Mohd Asri Mat Teridi, Norasikin Ahmad Ludin, Suhaila Sepeai, Kamaruzzaman Sopian, Nicholas Alderman, Lefteris Danos, Tomas Markvart	316
Solar Air Conditioning for an Institutional Building in Subtropical Climate M. G. Rasul, Ali M. Baniyounes, M. K. K. Khan	323
An Overview of Solar Thermal Desalination Technologies I. Ullah, M. G. Rasul, M. M. K. Khan	335
Thermal Performance Analysis of Rooftop Greenery System in subtropical climate of Australia <i>M. Anwar, M. G. Rasul, M. M. K. Khan</i>	341
Malaysian Low Cost Housing; Needs and Barriers B. Bakhtyar, A. Zaharim, K. Sopian, Ch. Lim	347

Spatial Drought Assessment Using Remote Sensing and GIS techniques in Northwest region of	355
Liaoning, China	
Fujun Sun, Meng-Lung Lin, Cheng-Hwang Perng, Qiubing Wang, Yi-Chiang Shiu, Chiung-Hsu Liu	
	2(1
Exploring Spatial Pattern of Tourist Behavior Using Geographic Information Techniques	361
Chiung-Hsu Liu, Tzu-How Chu, Meng-Lung Lin, Chia-Hao Chang	
Risk Assessment Mapping of Waste Dumping through a GIS-based Certainty Factor Model	367
Combining Remotely Sensed Spectral Unmixing Model with Spatial Analysis	
Tzu-How Chu, Meng-Lung Lin, Yi-Shiang Shiu	
Effect of Oil Spill Pollution in Malacca Strait to Marine Ecosystem	373
Jaswar M Rashidi A Maimun	515
Suswar, 141. Rashia, 11. Waiman	
	270
Authors Index	5/8

Solar Air Conditioning for an Institutional Building in Subtropical Climate



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Abstract: Air conditioning is one of the major consumers of electrical energy. The most of the ways of generating the electricity today, as well as the refrigerants being used in traditional vapour compression cooling system, produce greenhouse gas emissions which ultimately contribute to global warming. It is therefore necessary to develop process and technology to implementing renewable sources of energy for air conditioning to reduce greenhouse gas emissions and to achieve sustainable development. The use of solar energy to drive cooling cycles for space conditioning is relatively a new and attractive concept which mostly eliminates the need for CFC, HCFC or HFC refrigerants.

In this presentation an overview of a hybrid solar desiccant cooling system which has been designed and installed in an institutional building of Central Queensland University, Rockhampton campus, Australia is presented. Solar desiccant cooling technology consists of solar system, dehumidification system and a cheap chilling system like an evaporative cooling system. The main concept of desiccant cooling system is based on the system's capability of reducing vapours and moisture contents out of air using a physical sorption process. The conceptual bases of the technology, capability and limitations are outlined. The energy demand, energy consumption, and economic and environmental problem associated with the usage of fossil fuel resources in Australian commercial buildings and the issues of indoor air quality, mould growth and indoor thermal comfort are discussed. Furthermore, experimental and computational results of the performance of installed solar desiccant cooling system is presented and discussed. The results are analysed on the basis of energy savings, solar fraction (SF), primary energy used, coefficient of performance (COP) and desiccant system efficiency. Results showed that the installed solar desiccant cooling system at Central Queensland University can achieve 18% energy savings with maximum coefficient of performance of 0.83 and 48% desiccant efficiency.

Brief Biography of the Speaker: Associate Professor Mohammad Rasul obtained his PhD in the area of Energy, Environment and Thermodynamics from The University of Queensland, Australia. He received his Master of Engineering in Energy Technology from Asian Institute of Technology, Bangkok, Thailand. His first degree is in Mechanical Engineering. Currently, he is an Associate Professor in Mechanical Engineering of the School of Engineering and Built Environment at Central Queensland University, Australia. He is specialised and experienced in research, teaching and consultancy in the areas of thermodynamics, energy (industrial and renewable) and environment, and resource industries and sustainability. He has published more than 200 research articles/papers both in reputed journals and refereed conferences including 7 book chapters, two edited books, one awarded paper in a refereed journal and two awarded papers at conferences in the area of energy and thermodynamics. He has supervised more than a dozen of research higher degree (RHD) students (PhD and Masters) and currently supervising twelve. In the last five years he has secured more than \$2.4 million research grant. His research has made significant impact to national and international scientific communities through a large number of citations and hindex. He has also made significant contributions in engineering education research and scholarships in the area of project based learning and innovative teaching practices. He has edited two books, one on Developments in Engineering Education Standards: Advanced Curriculum Innovations and another on Thermal Power Plants. Currently he is editing Advanced Applications of Thermal Power Plants. His contributions to the professional community have been demonstrated through his varied roles and activities, such as membership of national and international technical, scientific and advisory committees, membership of different professional organizations and various organizing committees. He has been leading and contributing to the strategic research on Resource Industries and Sustainability in Energy and Environment.

Current Status of Renewable Energy Technology Options

Associate Professor Mohammad Alghoul Solar Energy Research Institute Universiti Kebangsaan Malaysia 43600 Bangi Selangor MALAYSIA Email: alghoul@eng.ukm.my

Abstract: World energy needs are the biggest challenge and are projected to increase sharply in the next decades. The non-renewable energy sources are finite and their extraction/usage is causing damage to the environment. For worldwide peace and prosperity, energy sector must be environmentally friendly, secure, efficient and cost effective in order to meet the world energy demand and world population trend. Renewable energy technology options could satisfy the global electricity, (heat/cool) demand and transport fuels. Current status of renewable energy sources and their technologies will be highlighted. Trend of global investment, global growth rates and market share of renewable energy are discussed. Renewable technology options in terms of cost and system capacity are also discussed.

Brief Biography of the Speaker: Assoc. Prof. Dr. Mohammad Alghoul obtained his BSc in Physics, MSc in Solar Energy & Energy Technology and PhD in Solar Energy. He is presently senior research fellow at solar energy Research Institute, a center of excellence for the research and development in solar energy technology, Universiti Kebangsaan Malaysia. He has been involved in the field of solar energy for more than 12 years. His main contributions are in (active/passive) solar (Thermal/Photovoltaic) materials and applications. He has published over 60 research papers in journals and conferences. He has delivered keynotes speeches at international and national conferences on renewable energy.

Energy Efficient Ventilating Residential Buildings



Professor Teet-Andrus Koiv Department of Environmental Engineering Tallinn University of Technology Estonia E-mail: teet.koiv@ttu.ee

Abstract: Residential buildings make up the largest share of buildings. The presentation deals primarily with energysaving ventilation problems in Eastern European residential buildings, a substantial part of apartment buildings. A large part of the apartments buildings in this area is naturally ventilated and were built in the years 1960-1990. Since the end of the last century such apartment buildings have been intensively renovated. First, low hermetic windows were exchanged, as a result of which air change decreased several times. The characteristics of indoor climate in such a situation are given. It has become clear that renovating the ventilation is essential. The possible solutions for renovating the ventilation in old apartment buildings are the following: -Installation of fresh air valves in buildings with natural ventilation - increase in heating costs.

-Balancing ventilation - almost impossible to use in renovating old apartment buildings (Difficult to install supply air channels).

-Apartment based balancing ventilation - difficult to use in old apartment buildings as people do not like duct installation in the flat.

-Exhaust mechanical ventilation with the heat pump and fresh air valves in living rooms - one of the possible solutions.

-Installation of the room based air handling units (AHU) and exhaust ventilators in the WC, bathroom and kitchen one of the possible efficient solutions. Since the latter two are energy efficient solutions – solutions based on heat recovery - the presentation focuses on their research results. The review and study of exhaust mechanical ventilation with the heat pump system in old and new apartment buildings are given. From room-based ventilation aggregates, the use of recuperative and regenerative AHU-s has been studied.

Brief Biography of the Speaker: T.-A.Koiv received his M.Sc. in Thermal Engineering from the Tallinn University of Technology and the PhD at the Institute of Civil Engineering of St Petersburg in Heating, Heat Supply, Ventilation and Air Conditioning in 1978. Since 2003 he has been Full Professor and Head of the Chair of Heating and Ventilation at the Tallinn University of Technology, Estonia. He has read several courses in the field of Thermal Engineering, Heat Supply, Heating, Ventilation and Air Conditioning, Renovation of HVAC systems at the Tallinn University of Technology. At present he supervises 6 PhD students. Prof T.-A.Koiv has 18 inventions and patents in the field of Heating and Heat Supply. He is an active researcher in the field of energy efficiency, indoor climate and building service systems. He is the author of the 10 book and textbooks. Dr. Koiv has published more than 100 papers in books, journals and conference proceedings. Prof. Koiv has received an award of Silver medal for his inventive activities at the Exhibition of the Achievements of National Economy.

He is vice dean (in the field of science) of the Civil Engineering Faculty of the Tallinn University of Technology and head of several projects (Baltic cooperation in energy efficiency and feasibility in urban planning – ENEF, Decreasing the consumption of heat energy by awareness rising and performance of consumers based on measurements of individual heating costs, Minimum requirements for energy performance - additional analysis, new international master program "Energy Efficiency of Buildings", Energy Auditing and Certification of Buildings, Doctoral School of Civil and Environmental Engineering). He is a member of CBI and WSSET. He has been reviewer of Journals and member of Scientific Committee of Conferences. His research and activity has made significant impact to national scientific and engineering communities.

Large Scale Solar Assisted Hot Water Heating Systems for Green Hospital



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Abstract: Concerns over the impact of the environment on the massive usage of fossil fuels, combined with soaring energy prices, triggered increased interest in the use of solar energy. One of the most attractive applications of solar energy is for hot water usage in the public and commercial sector. The available building surface for the residential, commercial and industrial sector is approximately 110,000,000 m2. Hence, the potential for solar heaters for Malaysia is 75 GW(thermal). There are over 100 hospitals and hotels throughout the nation that the existing hot water system can be converted to solar assisted system and hence increase the market of the solar energy systems. Hospitals and hotels utilized over 30 % of the total energy consumption for water heating. A case study of such facilities is the Hospital University Kebangsaan Malaysia (HUKM)) was presented. Presently, cold water enters the calorifiers directly, which are heated by LPG boilers. Larger amount of LPG is used and much amount of greenhouse gases is released. The hot water system for the hospital is provided by a boiler, total of eight calorifiers. The unit used to run 24 hours a day. The average solar radiation for Kuala Lumpur is 16.92 MJ / m² / day. The evacuated tube collectors with all the required controls system have been proposed and installed. Simple calculations on the energy output, savings on LPG and reduction of CO2 have been conducted. Preliminary results indicated that the saving on LPG based on proposed system was more than 20%. With a prospect of 100 hospitals and hotels throughout the nation, this project shall improve public awareness in energy conservation in the hot water production of their buildings and increase the market of the solar energy systems.

Brief Biography of the Speaker: Prof. Dr. Kamaruzzaman Bin Sopian obtained his BSc in Mechanical Engineering from the University of Wisconsin-Madison in 1985, MSc in Energy Resources from the University of Pittsburgh in 1989 and PhD. in Mechanical Engineering from the Dorgan Solar Laboratory, University of Miami in 1997. He is presently the Professor in Renewable Energy at the Department of Mechanical and Material Engineering, Universiti Kebangsaan Malaysia. Currently, he is the Director of the Solar Energy Research Institute, a center of excellence for the research and development in solar energy technology. He has been involved in the field of solar energy for more than twenty years. His main contributions are in solar radiation modeling, alternative material for solar absorber, solar water heating system with integrated storage system, solar desalination, solar cooling, daylighting using solar light pipes, solar assisted drying systems, grid-connected photovoltaic system, thin film silicon solar cells, combined photovoltaic thermal or hybrid collector and solar hydrogen production system. He has published over 400 research papers in journals and conferences. He has delivered keynotes speeches at national and international conferences on renewable energy. He is the founding member of the Malaysian Institute of Energy, member of the World Renewable Energy Network based in the United Kingdom and is an associate editor of the Renewable Energy and Sustainable Cities and Society published by Elsevier Ltd. He heads several national subcommittees on renewable energy by the Malaysian government to promote awareness, market enhancement, policy studies and the applications renewable energy.