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Latest Trends in Renewable Energy & Environmental Informatics

Proceedings of the 7th International Conference on Renewable Energy Sources (RES '13)

Proceedings of the 1st International Conference on Environmental Informatics (ENINF '13)

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Kuala Lumpur, Malaysia, April 2-4, 2013

Energy, Environmental and Structural Engineering Seriess | 8

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Plenary Lecture 1

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 h-index. 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.

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Plenary Lecture 2

Current Status of Renewable Energy Technology Options

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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.

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Plenary Lecture 3

Energy Efficient Ventilating Residential Buildings

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Abstract: Residential buildings make up the largest share of buildings. The presentation deals primarily with energy-saving 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.

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Plenary Lecture 4

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.

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