

Solar Energy Sciences and Engineering Applications

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Solar energy is available all over the world in different intensities. Theoretically, the solar energy available on the surface of the earth is enough to support the energy requirements of the entire planet. However, in reality, progress and development of solar science and technology depends to a large extent on human desires and needs. This is due to the various barriers to overcome and to deal with the economics of practical utilization of solar energy.

This book introduces the rapid development and progress in the field of solar energy applications for science and technology: the advancement in the field of biological processes & chemical processes; electricity production; and mechanical operations & building operations enhanced by solar energy.

The volume covers bio-hydrogen production and other biological processes related to solar energy; chemical processes for the production of hydrogen from water and other endothermic processes using solar energy; the development of thermo-electric production through solar energy; the development of solar ponds for electric energy production; and the mechanical operation with solar energy; the building operation with solar energy optimization and urban planning.

This book is an invaluable resource for scientists who need the scientific and technological knowledge of the wide coverage of solar energy sciences and engineering applications. This will further encourage researchers, scientists, engineers and students to stimulate the use of solar energy as an alternative energy source.

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Editorial Review

About the Author

Napoleon Enteria is the Managing Consultant of the Enteria Grün Energietechnik, Philippines. At the same time, he is a Visiting Researcher of the Faculty of Engineering, Tohoku University, Japan. He was a Research Staff of the Faculty of Engineering, Tohoku University, Japan, for the Industry-Academia-Government Collaboration. He was doing research in collaboration with different Japanese universities and companies with the prime support of Japanese government agencies in the area of solar energy, HVAC systems and building sciences. In addition, he provides technical and scientific advice to graduate and undergraduate students. He was a scientist with the Solar Energy Research Institute of Singapore, a component of the National University of Singapore, performing collaborative research with the Fraunhofer Institute of Solar Energy Systems in Germany, a German company and the Department of Mechanical Engineering of the National University of Singapore in the field of solar thermal energy, HVAC systems and membrane heat exchangers; the latter was supported by the Singaporean government agency during his stay in Singapore. Before going to Singapore, he was a Global Center of Excellence Researcher in the Wind Engineering Research Center of Tokyo Polytechnic University doing research in natural ventilation and airconditioning systems in collaboration with Japanese universities, companies and the Global Center of Excellence Program of the Japan Ministry of Education, Culture, Sports, Science and Technology. In addition, he was a guiding instructor to two undergraduate students for theses research. Napoleon has authored several scientific and engineering papers in books, review journals, research journals and conference proceedings. He has presented and submitted dozens of technical reports for collaborative projects with research institutes, universities and companies in different countries. He is regularly invited as reviewer for several international journals in the field of air handling systems, energy systems and building sciences. On occasion, he is invited to review research funding application and gives technical and scientific comments on international scientific and engineering activities. He is a member of the American Society of Mechanical Engineers (ASME), the International Solar Energy Society (ISES) and an associate member of the International Institute of Refrigeration (IIR). He was awarded his Doctor of Philosophy (2009) in engineering, specializing in Building Thermal Engineering at the Tohoku University, Japan, as Japanese Government Scholar; and his Master of Science (2003) and Bachelor of Science (2000) in the field of mechanical engineering from Mindanao State University at Iligan Institute of Technology, Philippines, as Philippine Government Scholar.

Aliakbar Akbarzadeh was born in Iran in 1944. He received his BSc degree in Mechanical Engineering from Tehran University in 1966. In 1972, he obtained his MSc and in 1975 his PhD, also in Mechanical Engineering and both from the University of Wyoming, USA. From 1975 to 1980 he was an Associate Professor and also Head of the Mechanical Engineering Department at Shiraz University in Shiraz, Iran. Later he worked at the University of Melbourne as a Research Fellow (1980– 1986), primarily doing research on applications of solar energy as well as energy conservation opportunities in thermodynamic systems. Since June 1986, Aliakbar has been working as an academic at RMIT University in Melbourne, Australia. During this period, he also worked as a visiting Fellow for half-a-year at the Nuclear Engineering Department of the University of California at Berkeley, USA, where he did research on passive cooling of nuclear reactors through computer modelling as well as experimental simulations. At present, Aliakbar is a Professor in the School of Aerospace, Mechanical and Manufacturing Engineering at RMIT University, and also the Leader of the Energy CARE (Conservation and Renewable Energy) Group in the same school. Aliakbar lectures in thermodynamics as well as remote Area power supply systems. He is the Principal

Supervisor of ten full-time PhD postgraduate research students on energy conservation and renewable energy systems. He has also one post-doctoral research fellow working with him on geothermal energy utilization for power generation. Aliakbar is a specialist in thermodynamics of renewable energy systems. His industry oriented research projects enrich his teachings and makes them relevant. He spends about half of his time in supervising industry supported research in energy conservation and renewable energy area, which also form a vehicle for postgraduate training of his PhD students. He has been the first supervisor of about 30 PhD candidates who have completed their degrees. Aliakbar has over 100 refereed publications and two books all in his area of specialization which is solar energy applications. One of his publications on solar energy won the ASME Best Paper of the year award in 1996. Aliakbar's industry-oriented research on energy systems has resulted in a number of Australia National Energy Awards for him, as well as a number of products, such as the Heat Pipe-based Heat Exchanger for waste heat recovery in bakeries, the Temperature Control of solar water heaters using thermo-syphons and an innovative system for simultaneous power generation and fresh water production using geothermal resources. Aliakbar has also been working on salinity gradient solar ponds as a source of industrial process heat and also for power generation. In the last 35 years he has developed several concepts related to salinity gradient maintenance, as well as efficient methods of heat extraction from solar ponds. At present, his research group is the world leader on applications of solar ponds.

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