Sustainability, Energy and Architecture

Case Studies in Realizing Green Buildings

Edited by
Ali Sayigh

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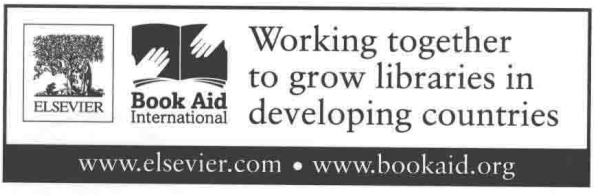

Preface

Sustainability, Energy and Architecture has been produced to serve architects, students and practitioners alike; a reference book for all those interested in buildings and their relationship to energy and the environment. Each of the 17 chapters has been written by a leading authority in their field. They highlight the practise of building design throughout the world, followed by critical analysis.

It is hoped that architects and builders will use and benefit from this world-wide experience and expertise. Both vernacular and modern architecture are addressed, and the text sets out the principles for architects to follow when designing buildings, giving full consideration to energy; whether embedded in the building materials or required to make the buildings comfortable for work or residence.

Special attention has been given to the GCC and the Middle East, where recent building development has, by and large, been erected for no rhyme or reason to solve the accommodation requirements of a large immigrant population of skilled and non-skilled workers, without thought for esthetic or planning constraints. Thankfully there are signs that this attitude is changing for the better.

The book also looks at the speed at which some regions of the world have changed from traditional buildings to modern skyscrapers and their neglect of the principles of sustainability.

The book includes more than 50 design case studies from the UK, The Netherlands, Germany, Italy, Sweden, Romania, New Zealand, Canada, the GCC, Iraq, Iran, Cuba and few selected countries from central and southern Africa.

As editor-in-chief, I am proud and honored to have worked with these eminent architects and building experts in putting forward this work of insight into building design, operation and experience.

Ali Sayigh
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Prof Mohsen Aboulnaga

He is an expert on Sustainable Development, Sustainability, Built Environment and Green Building. Dr Aboulnaga is a Professor of Sustainable Built Environment. His areas of competency including: strategy planning, policy development and tools, strategic environmental assessment, low-carbon society and scenarios, eco-friendly cities, green building policies and guidelines, renewable energy and climate change. In 2009, he was appointed Strategy & Policy Advisor – Environment & Infrastructure at The Prime Minister's Office of the UAE (February 2009 – March 2010). Prior to that, he held a position in the capacity of Strategy & Policy Advisor at The Executive Council, Government of Dubai from May 2007 to 2009. He was involved in developing Dubai Government Strategic Green Building Policy and Dubai Heat Island and Orthophoto Flyover Project in collaboration with Lawrence Berkeley National Laboratory. Dr Aboulnaga is author and co-author of more than 60 published int'l refereed journal and conference papers and holds a Ph.D. in sustainable building Environments from The University of Leeds, U.K.

Professor Khalid A Al-Sallal

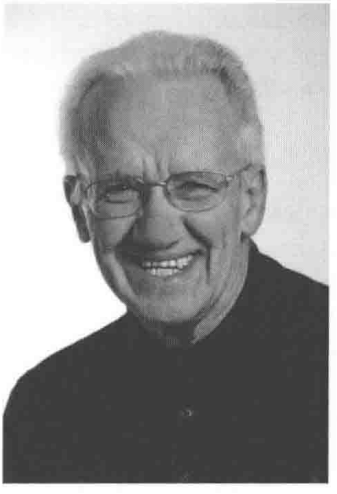
Dr Al-Sallal received a Master of Environmental Planning from Arizona State University in 1988 and a PhD from Texas A&M University at College Station in 1995. He has been teaching architectural engineering at the UAE University since 1996 and currently holds a professor rank. His area of expertise is architectural design with emphasis on building energy. His research has focused on building performance and simulation, carbon-neutral design and zero energy buildings. He is member of several organizations and societies and editor of few journals in the area of

architecture and environment and produced more than 40 publications in international refereed journals and specialized conferences. He designed several residential and public buildings including the Yemeni Ministry of Education in Sana'a and won architectural competition prizes for the design of the Yemen Kuwait Bank and the design of a commercial residential complex for the Yemeni Government in Sana'a. He received several awards for his work and design.

Arch Rahman Azari

He is a PhD candidate in Built Environment at the University of Washington. With a background in architecture, he has researched on various aspects of green buildings including green project delivery, energy-efficiency in buildings, environmental life-cycle assessments of buildings, etc. The outcomes of his research have been published as research papers in proceedings of many international conferences.

Professor George Baird



Dr George Baird is a Professor of Building Science at the School of Architecture, Victoria University of Wellington, New Zealand where he specialises in building environmental science and engineering services, building performance generally, and the energy efficient design and operation of buildings. At the Victoria University of Wellington School of Architecture he has been variously Director of Energy Research Group, Dean of Faculty of Architecture, Director of the Centre for Building Performance Research, and Associate Dean Research. He is currently a Fellow of the Chartered Institution of Building Services Engineers (UK), the Institution of Professional Engineers (NZ) and of the Institute of Refrigerating Heating and Air Conditioning Engineers (NZ), and a Foundation Member of the Energy Management Association (NZ). He was recipient of the 1999 NZ Science and Technology Bronze Medal "For singular contribution to energy efficiency of New Zealand

buildings and to building performance research....''; 'Pioneers of WREN Chairman's Award' of the World Renewable Energy Network for 'contribution to the world of renewable energy through publications, teaching and promotion of renewable energy'. Author and co-authors of innumerable technical papers and case studies.

Professor Dania González Couret

She is the Dean of Research, Faculty of Architecture, Havana, Cuba. Professor Couret she obtained her first degree in Architecture (ISPJAE, 1979); PhD (ISPJAE, 1994); Post-Doctoral Studies in Lund University (Sweden, 1997 and 1999); Doctor in Science (ISPJAE, 2007). Now, she is titular professor, and Vice Dean for Research and Postgraduate Education in the Faculty of Architecture in Havana. Prof Couret is President of the Academic Committee for PhD Program in Architecture and the Master Course in Social Housing. Vice President of the National Tribunal for PhD in Architecture and Urbanism, reviewer in Renewable Energy Journal and INVI (Housing Institute, University of Chile), and Member of the Jury in several international design competitions.

Dr Ruxandra Crutescu

Born in Bucharest, Romania, Ruxandra Crutescu is a University Lecturer at the Faculty of Architecture, "Spiru Haret" University, Bucharest, and is the Head of the Research-Development-Innovation Department at Passivehaus Institut, Bragadiru, whose founder she is. Her contribution to the scientific activity consists of approx. 80 articles published in various scientific magazines or on the occasion of national and international scientific conferences and a number of books having as main subject the ecological architecture, the durable development in architectural matters, the use of renewable energies in buildings and architecture, in order to reduce the greenhouse gas emissions and protect nature. As member of Architects' Order of Romania. Active participant to the life of the Romanian and the international scientific community, she is Reviewer and Associate Editor for different Romanian and international publications.

Dr Nada El-Zein

Nada is a naturalized US citizen who was born and raised in Beirut, Lebanon. She received her BS, MS, and PhD from the University of Illinois in Champaign-Urbana, IL and received the highest honors possible. While at U of I she was among a very select group of PhD candidates to study under the direct mentorship of Dr Nick Holonyak, the inventor of the LED. Nada subsequently worked at Motorola for 7 years where she was the R&D Manager for nanotechnologies. After Motorola she joined EpiWorks where she led the overall R&D effort for this epitaxial wafer manufacturer which produces HBTs/FETs (compound semi-conductor transistors for wireless applications), and high-power lasers and detectors for telecom and military applications. After EpiWorks she left the R&D world and joined the international company AkzoNobel, In 2007 Nada left AkzoNobel to start LED Light Energy LLC, in the USA and is now heavily involved in the design, specification and installation of LED fixtures in various projects.

Prof Dr Manuel Correia Guedes

Dept of Civil Engineering & Architecture Instituto Superior Tecnico, Lisbon, Portugal. Professor, Director of the Architectural Research Centre (ICIST-N8), Portugal. He is Director of the Architectural Research Centre of the Instituto Superior Tecnico (ICIST-Group 8). He is Responsible for several Disciplines of the courses of Architecture, Civil Engineering and Territorial Engineering. He is supervising several PhD and MSc students.

Participation in various research projects: Chief Coordinator of a COOPENER E.U. project (SUREAFRICA), National Coordinator of an ASIA-LINK project, Dr Guedes, participated in various international and national conferences, seminars and workshops. Published many papers and books. Since 1985 he participated in various projects, namely the Portuguese Pavilion in Seville's EXPO 92, two residential buildings in Vila Real, the competition for the National Assembly building, and the building of the Agronomy Faculty (UTL). He worked as an architect in several Portuguese architectural companies.

He published many articles and papers in the fields of bioclimatic architecture and the built environment.

Dr Neveen Hamza

Dr Hamza first degree was in Architecture and a PhD in Building Science. She has been involved in teaching and researching building environmental design since 1997. Her research transcends the fictitious barriers between building performance as a science, and its socio-cultural values which should ideally fuse to express its architecture. She published several papers in conferences and journals on environmental simulation of buildings including the thermal performance double skin facades in hot arid areas, as well as researching pragmatic issues of how building regulations affect the design team and setting policy for energy conservation in the mature built environments in the UK. She is a scientific reviewer in scientific journals including Energy, and Renewable Energy and also contributes on a number of scientific conference committees.

Ms Shawna Henderson

Shawna Henderson, CEO of Bfreehomes, has been working in the field of energy-efficiency and housing since 1992. Her experience with the R-2000 and EnerGuide for Houses (ecoENERGY) programs, coupled with research carried out for Canada Mortgage and Housing Corporation (CMHC) and Natural Resources Canada, provides the backbone of Bfreehomes consulting services. Shawna has worked successfully with eight to fifteen home design clients each year since 1992, on such widely varied projects as load-bearing straw bale homes, double-wall new construction, standard stick framing and gut rehabs of older houses. In addition, she worked using renewable energy in buildings. In 2010, Shawna participated on the Information Subcommittee of the Ener Guide for Houses Rating Service Upgrade Process. In 2007, she participated on the Selection Committee for CMHC's EQuilibrium House Initiative. Shawna has published books and papers in about building technology.

Professor Andrew Miller

Andrew Miller is Professor of Building Sustainability and Head of the Centre for Sustainability of the Built Environment (CSBE) in the School of Environment and Technology at the University of Brighton in the UK. He is also adjunct professor in the School of the Built Environment at Curtin University of Technology in Perth Australia. He is a chartered Building Services Engineer with over 30 years of experience in research related to the environmental performance of buildings. His research includes the embodied energy of materials, thermal performance of buildings in operation as well as recycling of materials at the end of the useful life of the building. He is particularly interested in passive building design and in low carbon refurbishment of existing buildings.

Prof Bahram Moshfegh

He studied at the Linköping University, Sweden, where he received a PhD degree in Energy Systems in 1992. He was appointed Professor of energy systems there in 2000. Professor Moshfegh is the Chairman of Division of Energy Systems at the Linköping University since 2000. He has been involved as expert for Swedish parliament and funding research council both nationally and internationally, member of the scientific committee for the Swedish Research School Energy Systems, member of the scientific committee and organization committee as well as invited speaker for many *International Conferences.* Referee for many international journals and international conferences in the field of energy and building. Professor Moshfegh was the Chairman for the *World Renewable Energy Congress (WREC-2011) on May 8–13, 2011* in Linköping, Sweden. Professor Moshfegh has authored or co-authored more than 150 papers and research reports mainly presented in international journals or at international conferences with referee.

Professor Dr.-Ing. Helmut F.O. Müller, Architect

1966–1971, Study of Architecture at University of Hanover and Stuttgart (Diploma), 1971–1972 DAAD scholarship at the London University College (School of Environmental Studies/Bartlett School) 1972–1982 Professional activity in design and research 1979-Doctor's Degree at the University of Stuttgart (Dr.-Ing.) 1982–1993 Professor at the Polytec of Cologne, Department of Architecture 1991–1997-Foundation and director of the Institute of Light and BuildingTechnology at the Polytec of Cologne (ILB), 1993–2009 Univ. Professor, Chair of Environmental Architecture, Department of Building, University of Dortmund 1997–2005 General Manager, GLB, Gesellschaft für Licht und Bautechnik mbH, Dortmund since 2006, he was deputy chairman of FiTLicht e.V. Development Association Innovative Daylight Utilization. Since 2008, a director of Green Building R&D, Düsseldorf, Partner of office consortium, 4greenarchitecture, Düsseldorf. Member of board of directors, Schuermann Spannel AG, Bochum.

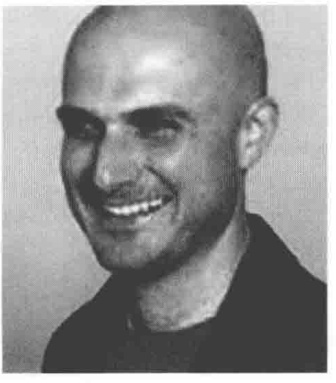
Professor Marco Sala

Marco Sala, graduated from University of Florence in Architecture in 1972 is registered architect since 1973, Chairman of Marco Sala Associates, Architecture and Energy Consultants, he specialises in passive solar systems in architecture, environmental design and energy conscious building design. Full Professor in Architectural Technology at the University of Florence. Founder and Director of ABITA Inter-university Research Centre based in Florence University, Director of European Master ABITA in Sustainable Architecture, has extensive experience in European research projects, as group leader and coordinator (JOULE, ALTENER, SAVE, VII FW, EIE) Fonder member of TIA (Teaching in Architecture Energy and Environment World Network). Published many papers and books in Architecture Practice.

Professor Ali Sayigh, BSc, DIC, AWP, PhD, F Inst E, F IET, CEng

Chairman and founder of World Renewable Energy Congress and Council which been held in 23 different countries up to now, Director General of World Renewable Energy Network (WREN) since 1990, Chairman, Founder of the Arab Solar Energy Society, Past Chairman of the UK Solar Energy Society, Director of Solar Seminars at ICTP-Trieste, Italy between 1977–1995, Professor and head of Solar Energy in Saudi Arabia, Kuwait, and Reading Universities from 1969 to 1994. Presently he is professor at the University of Hertfordshire. Founding member of the Arab Science and Technology Foundation (ASTF), Shaijah, UAE, Fellow of the Institute of Energy; Fellow of the Institution of Electrical Engineers; and Chartered Engineer. He published more than 400 papers and contributed and edited more than 30 books. He is editor and editor in chief of several international journals including the one which he founded in 1983 Solar and Wind Technology. This journal in 1990 is called The International Journal of Renewable Energy which is published by Elsevier Science Ltd. He is Editor-in-chief of Comprehensive Renewable Energy, will be published in March 2012, by Elsevier Company. Prof Sayigh established with Sovereign Publications the annual Renewable Energy Magazine since 2000, Co Editor-in-chief of ICPSR Journal "ISESCO Vision of Science and Technology". Editor of International Journal of Environmental Sciences and Technology. He was Professor at King Saud University, Reading University and University of Hertfordshire (1978–2004). He graduated 32 PhD Students in various Engineering, Building Technology and renewable Energy. Prof Sayigh is chairman of Iraq Energy Institute. Editor-in-chief of Comprehensive Renewable Energy with 154 contributors.

Arch Nazar Sayigh



He is Director of Architecture, Glas Architects. Nazar is a fully qualified architect and chartered member of the RIBA with over 14 years of professional experience. Prior to setting up Glas, he worked for a number of award-winning design firms including Buschow Henley Architects and Mary Thum Associates. More recently his firm has been responsible for some of South London's most distinctive and successful mixed use housing developments, including 1 Druid Street and 134–144 Southwark Bridge Road. Glas

currently undertake a wide range of design led projects from small commercial fit out schemes to large scale master planning exercises. Nazar is a member of Southwark Council's highly acclaimed Design Review Panel, a steering committee member of The World Renewable Energy Congress, an RIBA competition assessor and has been an invited guest critic at the Bartlett School of Architecture and East London University school of Architecture.

Dr Maryam Singery

Maryam Singery is an assistant professor in Urban Studies at Islamic Azad University, Iran. She was born on February 02, 1976 the city of Tabriz, Iran. Presently Ph D, Urbanism (Candidate) at the Faculty of Art and Architecture, Science and Research Campus, Islamic Azad University, Tehran, Iran. She obtained her M.A in Architecture during (1996–2003) on Islamic Azad University, Tabriz Branch in Iran. Full time Staff Member of Architecture and art Department at Islamic Azad University, Tabriz Branch, central Instructor from 2002 up to this date. She participated in two International Congresses: the World Renewable Energy Congress IX, Aug 2006, Florence, Italy and the 2nd PALENC Conference and 28th AIVC Conference, September 2007, Greece

Professor Wim Zeiler

Wim Zeiler studied Mechanical Engineering (Design and construction; Methodical Design) at the Technische Universiteit Twente. In 1983 he started working in Kropman Building Services contracting, in which he currently holds the position of specialist building services technology. In 2001 he became full professor Building Services at the faculty of Architecture, Building and Planning at the Eindhoven University of Technology. His current research is on Integral Design, Agent technology, Climatic Design and Renewable Energy in the Built Environment. He is member of the board of advice of ISSO (Dutch society for stimulation of research on building services in the Netherlands) and participated in many different committees and boards within the TVVL (the Dutch Society for Building Services in the Built Environment).

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