

# Sustainable Building and Built Environments to Mitigate Climate Change in the Tropics

Tri Harso Karyono • Robert Vale • Brenda Vale  
Editors

# Sustainable Building and Built Environments to Mitigate Climate Change in the Tropics

Conceptual and Practical Approaches

 Springer

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# Preface

This book is about presenting solutions to problems of the built environment due to the current changes of the world climate. A number of efforts have been made in different parts of the world to attempt to minimize it. This book presents some conceptual and practical approaches to respond to this phenomenon with a particular focus on the tropics.

The book is a compilation of selected articles presented in the 2015 Tanri Abeng University Conference in Jakarta, Indonesia. This international conference was organized jointly by the School of Architecture, Tanri Abeng University, Indonesia; London Metropolitan University; England, and Heriot-Watt University, Scotland.

Seventeen articles have been selected as chapters which are grouped into four parts to form the book. The first part of this book deals with the general issue of climate change. It discusses the causes and the ways of mitigation and adaptation of the built environment to climate change. This first part discusses the development of some developing countries, such as Indonesia, in which improving a nation's well-being would need a massive development of the nation's infrastructure and its built environment. The massive developments of infrastructure and the built environment have triggered the use of fossil fuel and other earth's resources, emitting huge amounts of carbon dioxide, creating global warming and climate change. Some conceptual strategies to overcome these problems are discussed in this part. The concept of sustainability, in which reducing carbon emissions was seen as likely to be the only way to reduce global warming, is challenged. The renewable energy sources, which emit low carbon, are still demanding land to generate the energy, raising the ecological footprint. There are articles in this part that discuss the way to mitigate climate change in non-tropical climates, and these can be used as a comparative study for a tropical case.

The second part of this book offers articles that examine the way to overcome disasters in the city caused by climate change. The Indonesian capital city of Jakarta has suffered from frequent floods, creating problems not only for the fishing settlements in the coastal areas but also for those living in the centre of the city. Some proposed strategies to overcome these problems are discussed in this part. The way to reduce the urban heat island (UHI) effect in the urban areas is also discussed in

this chapter. It deals with the Singaporean problems of land being covered mainly by hard surface materials across the country. Along with the problems of flood, Jakarta is also suffering from traffic congestion, creating air pollution in the capital city. In this part, a bicycle lane system is proposed to improve the air quality and at the same time reduce the traffic congestion and the carbon emissions in this city.

The third part of the book deals with some practical approaches to make buildings that can help to mitigate climate change by reducing their need for nonrenewable energy. It proposes ways to reduce cooling energy by means of passive design in tropical buildings, such as in Malaysia. Examples are given of how buildings can be designed in such a way that solar heat gain is kept to a minimum, to create low indoor temperatures with a minimum help from mechanical means, thus reducing building energy consumption and promoting low-carbon buildings.

The last part of the book deals with the role of plants in mitigating and adapting the built environment to climate change. The impacts of plants as vertical and rooftop gardens to reduce the adjacent outdoor temperature as well as the indoor temperature in Singapore are discussed in this part along with the use of banana fibre as a possible source of building materials in Brazil.

I would like to thank all of the contributors who submitted their articles compiled in this book. Gratitude is given to Springer, the publisher which kindly publishes this book. I would also like to thank Fergus Nicol and Sue Roaf for their efforts to invite authors to submit their articles in our successful conference.

Jakarta, Indonesia

Tri Harso Karyono

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# About the Editors

## **Professor Tri Harso Karyono**

Tri was trained as an architect at the Department of Architecture, Bandung Institute of Technology (ITB), Indonesia, from which he received an engineering degree (Ir.) in architecture. He received a master's degree (MA) in architecture from the University of York, England, following the completion of his dissertation on "Solar Energy and Architecture: A Study of Passive Solar Design for Hospital Wards in Indonesia". Tri was awarded a doctorate (PhD) from the School of Architectural Studies, University of Sheffield, England, after finishing his thesis on "Thermal comfort and energy studies in multi-story office buildings in Jakarta, Indonesia".

Teaching in a number of architectural schools in Jakarta and also acting as doctoral external examiner at various universities, he has published a number of books on sustainable built environment and tropical architecture. His book on green architecture (in Bahasa Indonesia) (2010) has been reprinted three times within 6 years of publication. His latest book *Tropical Architecture: Form, Technology, Comfort and Energy Use* (in Bahasa Indonesia) (2016) tries to reposition the term of tropical architecture, which has been misinterpreted by many Indonesian scholars as a vernacular architecture. Tri has also been publishing a number of scientific articles, particularly related to thermal comfort in the warm and humid tropical climate in a number of international journals. He has published numerous articles in a number of Indonesian newspapers and architectural magazines. He designed his low-energy house at the outskirts of Jakarta in 2007. This house consumes very little electricity and is fairly comfortable without air conditioning.

Tri was awarded a professorship by the Indonesian Ministry of Education in 2007 and presented his inaugural lecture entitled "From Thermal Comfort to Global Warming: Architecture and Energy Points of View". His research interests are in the fields of thermal comfort, tropical architecture, sustainable built environment and low-carbon town.

**Professor Robert Vale and Professor Brenda Vale**

Robert Vale and Brenda Vale are architects and academics who studied architecture together at the University of Cambridge and wrote their first book on sustainable design, *The Autonomous House*, in 1975. Following their design of several award-winning buildings for the National Health Service in the UK, they built the UK's first autonomous house in 1993 and the first zero-emissions settlement, the Hockerton Housing Project, in 1998. It was the analysis of the performance of these buildings that revealed the importance of behaviour and led to their current research into ecological footprints, using the concept initially devised by Wackernagel and Rees in Canada in the 1990s.

The Vales have received a number of international awards, including those from the United Nations and the European Solar Energy Society, for their work. They carried out the initial development of the Australian government's National Australian Built Environment Rating System (NABERS) which has now been put into operation. Their 2009 book, *Time to Eat the Dog? The Real Guide to Sustainable Living*, used the ecological footprint to look at the environmental impact of how we live today, including the impact of household pets. Their surprising finding, subsequently supported by other researchers, was that a big dog in a western country has a similar impact to that of a person in Indonesia. More recently, they edited a book called *Living Within a Fair-Share Ecological Footprint* which comprised a series of studies written by colleagues, former students and current postgraduates. They are currently collaborating on a book that compares the ecological footprint of daily living around the world. Their areas of research at present are in the fields of sustainability, resilience, building materials and architectural history.