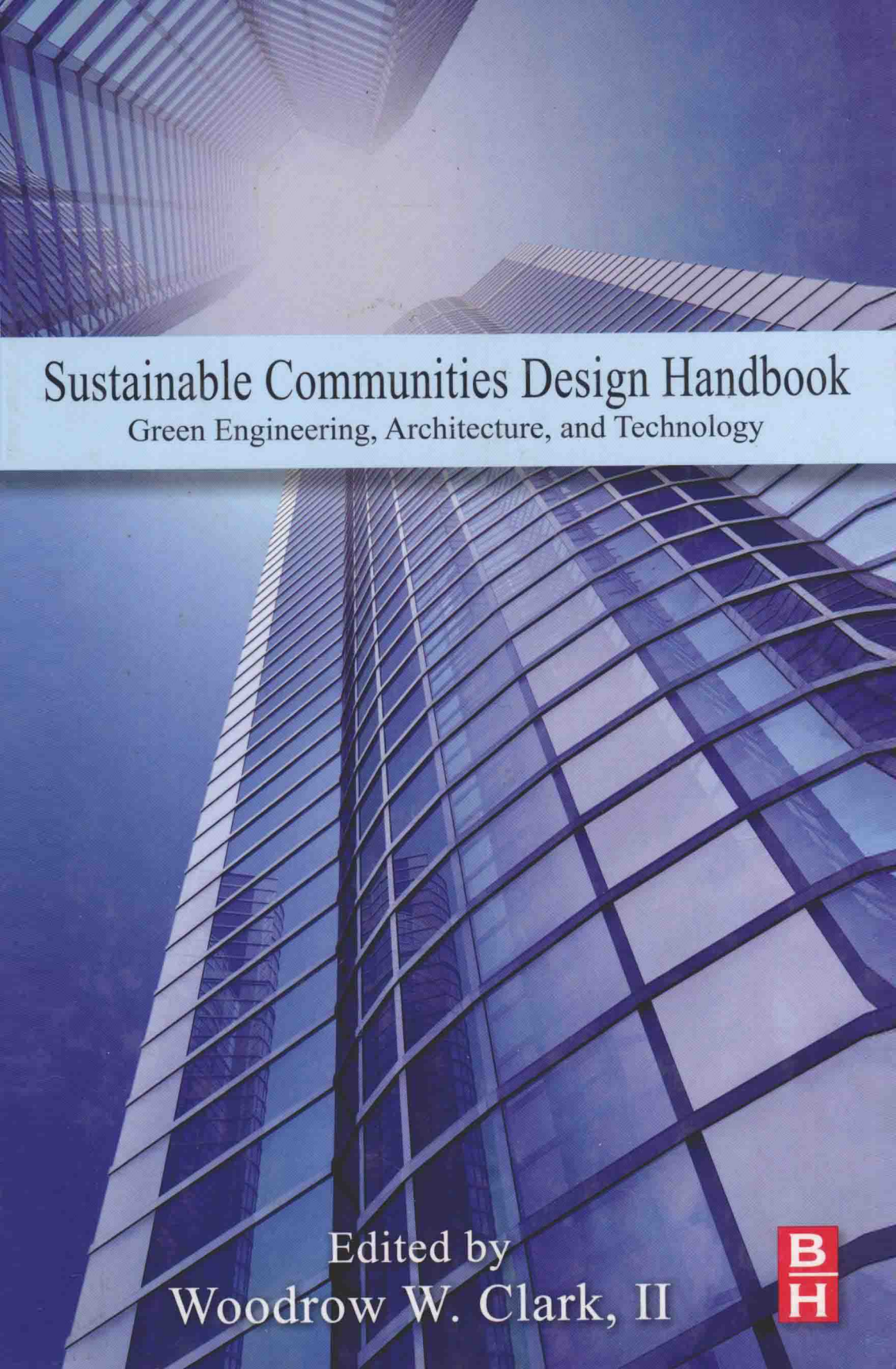




Sustainable Communities Design Handbook

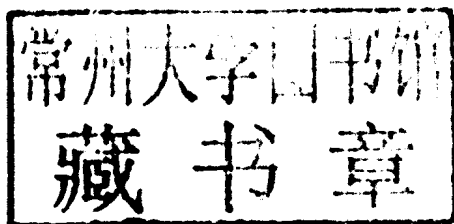
Green Engineering, Architecture, and Technology

Edited by
Woodrow W. Clark, II



Sustainable Communities Design Handbook

*Green Engineering,
Architecture, and
Technology*



Woodrow W. Clark, II, Ph.D



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Sustainable Communities Design Handbook

After authoring over a dozen books throughout my career, I appreciate and admire such a book as *Sustainable Communities Design Handbook*, since it identifies and brings applied skill sets in line with actual needs for our communities of any kind to become sustainable. This book represents a landmark for others to follow. Communities of all kinds need the tools that the book discusses in order to stop climate change.

Jeremy Rifkin

Founder/CEO, Foundation on Economic Trends
Bethesda, Maryland

My entire career has been dedicated to understanding, operating, and now regulating the energy sector. In many ways, both Edison (as CEO for a decade), in the private energy sector (started an energy company) and now CPUC (as Chair for another decade) has meant that I needed some knowledge about each of the chapters in the book. From law to economics to technologies with engineering and designing, in order to make communities sustainable there a number of different skill sets. The *Handbook* should be on everyone's shelf or computer as a reference, a guide with tools and inspiration that sustainable communities are and have been achievable.

Mike Peevey

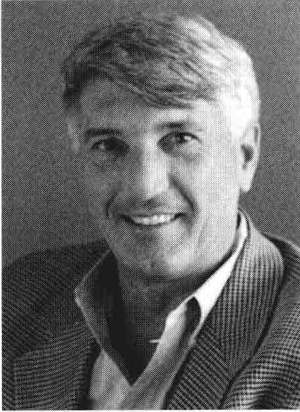
Chair, California Public Utilities Commission
San Francisco, California

Woody and I have known each other for over two decades. We have been in the trenches together working on bringing renewable energy systems to local on-site use for generating power. Our first meetings in the 1990s began with the UN IPCC's Third Assessment Report and the Special Report on Technology Transfer. Since then, while going our different ways, we have stayed in constant touch. The *Sustainable Communities Design Handbook* represents yet another milestone in his career, but even more

significantly an advance in the field of systems sustainability. In his latest work the field now has a guidebook that documents and explains the use of academic skills in the actual real world in order to stop and reverse climate change. This applied academic handbook to mitigate global warming/cooling is long overdue and needed by everyone. Let there be more.

Dan Kammen, Ph.D
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PREFACE

This book reflects at least a decade (1990s into the 21st Century) of my applied work in the environmental and energy sectors, both of which are critical in understanding and making sustainable development for any community.

For any author, the creation of a book and what needs to be done to finish it in a timely manner are significant. And, in this case, authoring a book does not pay anything, certainly not enough for the time that is spent on it. However, what most people do not understand is that the creation of a book takes time and is thoroughly reviewed by the publisher. Elsevier Press, with whom I have had a decade of peer review relationships for a book (*Agile Energy Systems*, about the global lessons learned from the California energy crisis, 2004) and several journals in the energy sector to which I have been a contributor as well as associate editor and special edition editor.

The peer review process was extensive for this book. Sustainable development, as a field, has developed and hence created the need for mechanisms or tools in which to implement sustainable buildings, communities, and regions as well as nation-states. A key issue is how to define *sustainable development* (which comes in Chapters 1 and 2) and identify what these mechanisms are. Given my experience, the mechanisms include technologies (storage devices and wireless smart grids), standards (such as Leadership in Energy, Environmental Design from the U.S. Green Building Council), economics and accounting, including finance, that are created as legal contracts (power purchase agreements and feed-in tariffs) as well as architecture and design for buildings and their surroundings, including transportation, water, and waste systems.

This book contains chapters on each of these topics. I purposely avoided chapters on each topic but rather have them include the application of the mechanisms. After Chapter 1 introduces the book, Chapter 2 discusses the Third Industrial Revolution. In other words, the world today is moving rapidly from the Second Industrial Revolution of fossil fuels and nuclear power to renewable energy, new technologies, and smart communities. This dramatic industrial change affects and guides the “paradigm shift” that sustainable development represents.

Hence, Chapters 3–11 reflect these basic concerns as to applied mechanisms and tools covering the setting of public policy (Scott McNall), technologies (Alison Gangl, Ben Johnson, Calvin Kwan, Andrew Hoffman, and I),

design and architecture (Christine Magar), economics and accounting (Tom Pastore, Arnie Sowell, Don Schultz, and I) to legal and contract areas (Doug Yeoman) and how the communities are connected through smart grids (Jerry Jin).

In particular, however, I wanted to “push the envelope.” Therefore there is a chapter (13) from a recent college graduate (Sierra Flannigan) on her experiences as a student creating viable, organic agricultural products. I also include a chapter (14) on a city in Denmark by Henrik Lund and Poul Alberg Østergaard so the reader can see how a nation like Denmark has gotten ahead of the sustainable development curve to power an entire city on 100% renewable energy. These examples are critical for understanding on how society needs to both empower itself (especially the youth of today) and have successful examples that work in the real world.

I thank, in particular, Ken McCombs, from the publisher’s office at Elsevier. He has been both an inspiration and motivation for this book. Ken not only came through after I had to respond to six reviewers and answer their questions but also kept after his staff and me to perform. Like me, Ken sees this book as a standard manual, which has useful tools for all practitioners, but also will be available online and as a series in the future. Indeed, I hope so. This topic will change, as it should. The chapters will need to be revised, as they should. And the content will expand, as it should. The biggest issue will be to measure the positive impact on our environment and communities. That will generate a whole new area of literature, data, and analyses. All of this is needed, *not* later but *now*.

In that context, I am dedicating this book to my wife Andrea and our son Paxton. Without their total support and encouragement (hard for a two year old, but he has certainly done that) the book would not have been completed. I especially want this book to help my son in his future life, because my generation (the Baby Boomers) left him with a world that is becoming increasingly environmentally polluted and economically dysfunctional. The solution is in sustainable developed communities—that is, ones that are transformed, rebuilt, or even created so as *not* to violate or harm their environment or others around them or far away. What we do locally, affects others globally. We need to stop now and implement the solutions that exist and will be created in the near future.

Woodrow W. Clark, II

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Introduction

Woodrow W. Clark, II, Ph.D

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8

Books are often difficult for a number of reasons. This one is an exception. The topic of sustainable development has been part of my lexicon for over two decades. While the terms were first used in the late 1980s in the Brundtland Report for the United Nations, they were and still are the subject of much debate and, to some extent, controversy. The reasons are complex but the terms are now common and in constant use, particularly with the wide release and acceptance of Al Gore's film, *An Inconvenient Truth*, which won Gore both a Nobel Peace Prize (along with the members of the UN Intergovernmental Panel on Climate Change, to which this author was a corecipient) and an Academy Award in 2007. Each of those honors alone was a remarkable accomplishment, but the deeper value was the global awareness of climate change and the need for solutions.

My last book, *Sustainable Communities* (Clark, 2009a), was a series of case studies in sustainability that were actually implemented. The communities ranged from a public elementary school and community colleges in the nonprofit world to city governments, corporations, and businesses from around the world. The idea was to provide models to understand the breadth and depth of sustainability as a concept and mechanism for action.

Sustainable development thus has become an acceptable policy initiative and programmatic implementation strategy. However, the “devil is still in the details” as to what *sustainable development* means. On the one hand, some businesses and governments see sustainable development as a strategy for building more homes, office buildings, and large communities. To acknowledge that communities were sustainable, groups formed to provide scores and credit points. The most popular one in the United States is the USGBC (U.S. Green Building Council), which developed a scoring mechanism called *Leadership in Energy and Environmental Design* (LEED), whose basic score starts with being “accredited” goes to its highest, being “platinum.”