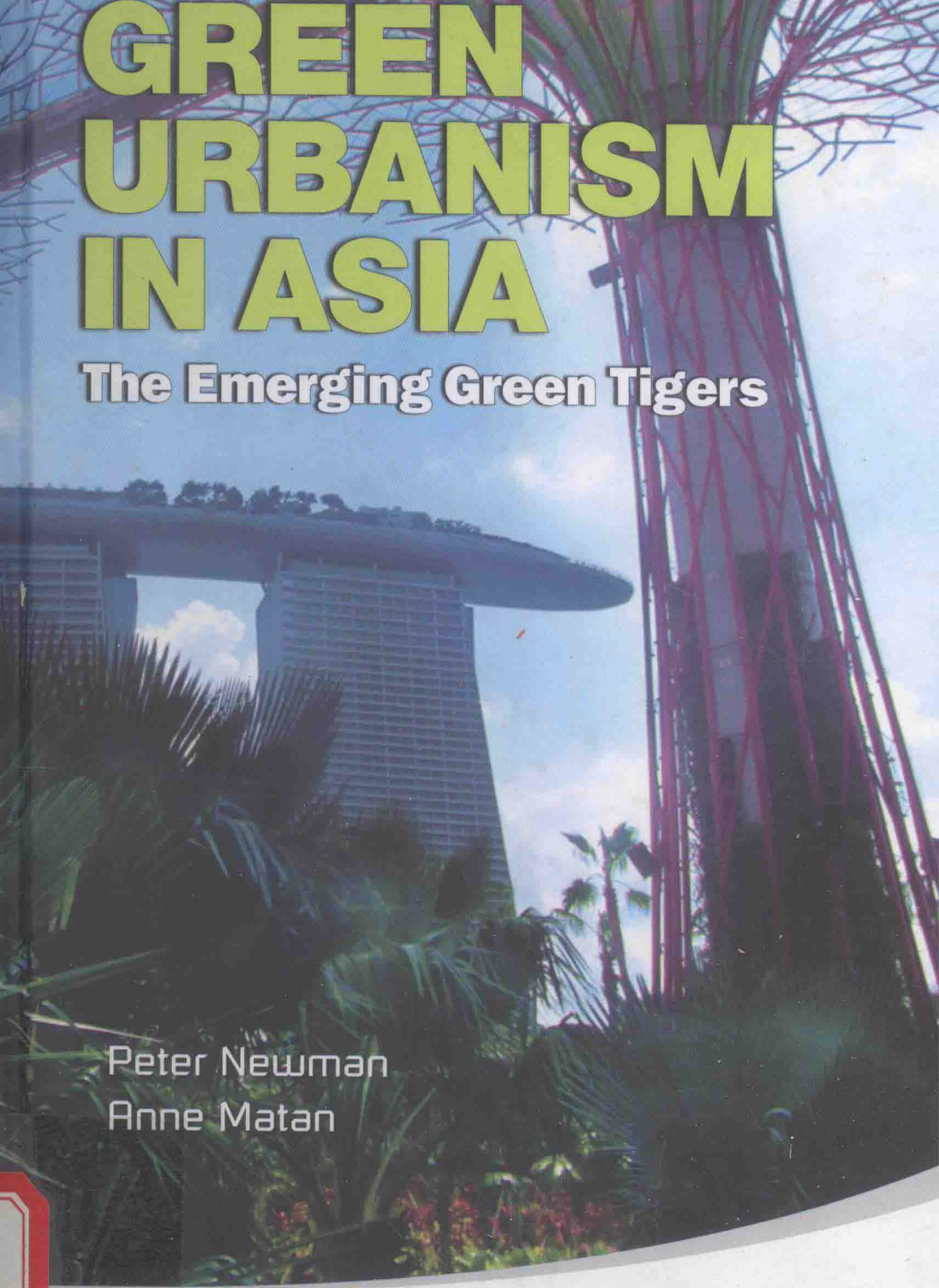
GREEN URBANISM IN ASIA

The Emerging Green Tigers



Peter Newman
Anne Matan

World Scientific

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The Emerging Green Tigers

Peter Newman • Anne Matan

Curtin University, Australia

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Preface and Acknowledgments

Green urbanism is a recognition that cities make the opportunities that change the world and we need green innovations to save the world. The green and the urban have not always sat easily together. Today, cities must be green for the sake of people, the environment and economies. This is the biggest agenda of our day and we wanted to see the extent to which Asian cities, the economic growth engine of the world, are also taking on green urbanism.

This book was inspired by the work of Professor Tim Beatley from the University of Virginia Charlottesville. His books *'Green Urbanism in Europe'* and the co-written *'Green Urbanism Down Under'* started the tradition into which this book fits.

Our book was constructed with a lot of help from the students completing their Masters in Urban Design at the National University of Singapore. They were the 'forward scouts' in checking out the green urbanism territory in Asia. Their personal insight into their home cities has permeated every page. We hope we have done justice to their aspirations for a greener urban future.

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Peter Newman and Anne Matan
Curtin University Sustainability Policy (CUSP) Institute

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CHAPTER ONE

Introduction

In February 2011 a new book was launched in Singapore called *'How Asia can Shape the World: From the Era of Plenty to the Era of Scarcities'*. The author, Jorgen Oerstrom Moeller, was a former diplomat from Denmark who is a close observer of Asia and who can see that there is a major tide change in global affairs. He believes that the era of scarcity has begun as the limits of the earth are consumed by modern industrial economies based on the American model. The next century, he suggests, will be the time for Asia to demonstrate to the world how to create a different kind of global economy that is more sustainable and is based on "shifting of productivity from the individual to groups, ecological productivity instead of economic productivity, and a reversal to traditional Asian values — less materialistic than Western values".

Our book is written to investigate the first signs of this changing economy. It focuses on cities because that is where the growth and dynamism of change is happening globally and especially in Asia. Here is an opportunity to demonstrate the new paradigm and we went looking to see if we could find the first signs of this as they are unfolding.

This book is a collection of stories as the trends and data are not yet available to really assess the impact of the changes we are observing. The idea of urban stories changing the world is not new. Jane Jacobs developed a view that innovation occurs through urban economies copying each other with each one building better versions (Jacobs, 1984). Stories, especially stories of hope, are powerful as they fire the imagination and give a hint that a better future may be possible. This has been the

basis of several other books that Peter Newman has written and been associated with (Beatley and Newman, 2009; Newman and Kenworthy, 1999; Newman *et al.*, 2009).

The ideas that will shape our new urban economies are beginning to emerge as cities across the world begin to grapple with the overlapping issues of global climate change, peak oil, global biodiversity decline, loss of cultures, and the many challenges for housing and infrastructure faced by cities flooded with new migrants from their rural hinterlands. We do not spend time detailing these problems; the literature is full of that. Instead, we want to show that the problems are being understood and the first steps towards a resolution are there, at least in demonstration form.

The hope that we have generated in this book is based on the ideas of innovation waves, that human societies and especially cities have adapted to over the past few hundred years. This notion is expressed in Figure 1.1 showing how economic cycles have followed these waves. It

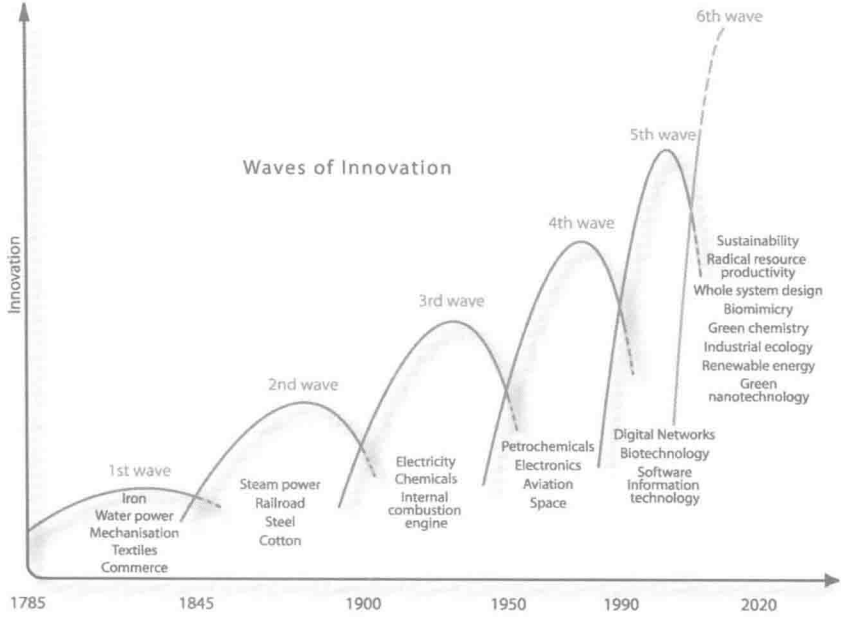

Figure 1.1 Waves of Innovation.
Source: Hargroves and Smith, 2005.

shows how the waves of innovation take off after periods of economic decline and lead to the next form of economy and with it the next form of cities. This approach has been outlined in detail in Newman *et al.* (2009).

The next phase of economic development as shown in Figure 1.1 is a combination of digital and sustainability technologies. But in no period of history has there been a simple change of technology that has renewed and reformed the economy, it has always involved changes in the way business has been done and changes in the way cities have been formed, designed and managed (see Box 1.1).

Box 1.1 Economic Waves, Urban Infrastructure and City Form

The First Wave cities were traditional Walking Cities with some use of horses and carriages while new industries began to develop along rivers and canals using water power.

Then the Second Wave cities spread out along the railways of the steel and steam era. European cities have retained much of this corridor type of city and the remains of the Transit City are still apparent in US and Australian cities with their pearls along a string.

The Third Wave of electricity and the internal combustion engine saw electric tramways built as the basis of most cities, especially in the growing cities of America such as Los Angeles which had the world's most extensive tramway system. These cities followed linear development patterns along the tramways. At the same time the first cars and buses were appearing though they did not begin to dominate city form.

Then the Fourth Wave was dominated by cheap oil, which enabled cities to spread and sprawl for 50 miles or so in every direction. Thus were created the Automobile City forms that confront us today with the biggest challenge of responding to fossil fuel reductions, especially petroleum.

The Fifth Wave of IT and digital technologies has not shaped cities much other than to replace the old industrial manufacturing parts of central and inner areas with knowledge jobs, thus helping to minimize some of the sprawl and start the renewal of these older industrial sites from the previous Waves. However, the Fifth Wave still had cheap oil-enabling cars to dominate cities.

(*Continued*)

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The Sixth Wave coincides with the end of cheap oil and the beginning of radical resource productivity of a kind that can deliver 50–80% less fossil fuels by 2050. It also includes a start of a new series of sustainability technologies related to renewables and distributed, small-scale water, energy and waste systems (building on clever control systems now perfected from the Fifth Wave), all of which are more local and require far less fuel to distribute.

This all means the city can become much more polycentric. The transport systems that support such energy and such polycentricity appear to be new electric transit systems for fast cross-city movement and a series of small-scale electric and hybrid vehicles for small local trips as well as walking and cycling which have survived all the city form changes. The polycentric centers and the remaining suburban buildings all need to be renewed as solar-based with all the eco-technologies of the Sixth Wave.

Source: Derived from Newman and Kenworthy, 1999.

This book will try to set out first of all what are the characteristics of the new city in this Sixth Wave. There are many words that are being used to describe this new kind of city — 'sustainable city', 'resilient city' and 'green urbanism' because it is simpler and more easily understood. Thus the book will begin in Chapter 2 to describe what green urbanism is, based on our experience in Western industrial cities. Based on the seven characteristics we have used, it will then seek to show the emerging trends and stories we have found across Asia.

The question underlying this investigation is whether Asian cities will take on or even take over this green urbanism agenda. It is estimated that by 2030, the urban population will reach five billion, or 60%, of the world's population. This is largely contributed to by the urbanization occurring in the Asian region. Asia's cities are predicted to be home to more than 60% of the world's urban dwellers by 2050. This is a threat if Asian cities develop according to the Western Fourth Wave model, but if it uses the growth opportunity to build cities as models of the Fifth to Sixth Wave — the green urbanism era — then they will show the rest of the world how it can be done. The Organization for Economic Co-operation and Development (OECD) and the

United Nations Environment Programme (UNEP) have been saying for the past decade that the next economic agenda is the green economy or green growth (OCED 2011a, 2011b) or green urbanism, as the Asian Development Bank calls it (Asian Development Bank, 2012). This book will look at the urban expression of this new agenda as it merges the Fifth and Sixth Waves of Innovation. Will green urbanism in Asia help shape the world in the age of scarcity?

CHAPTER TWO

What is Green Urbanism?

2.1. Green Urbanism

Green urbanism is often used as a way to describe settlements that are smart, secure and sustainable. They are smart in that they are able to adapt to the new technologies of the 21st century, secure in that they have built-in systems that enable them to respond to extreme events as well as being built-to-last, and sustainable in that they are part of the solution to the big questions of sustainability, such as climate change, peak oil, and biodiversity. Green urbanism has been applied by Beatley (2000) to European exemplar cities and to innovations across Australian cities by Beatley and Newman (2009). But the ideas have not been applied to Asian cities, yet.

This book will use the ideas of Newman *et al.* (2009) on what constitutes the main characteristics of resilience in cities as the overlap with the ideas behind green urbanism are very similar. Seven characteristics are outlined to help define these features and they are illustrated from around the world before applying them to Asian cities.

2.2. Innovations in Green Urbanism

Globally, there are seven features of green urbanism that are emerging. These are described as seven archetypal cities:

- The Renewable Energy City
- The Bioregional Carbon Neutral City
- The Distributed City
- The Biophilic City

- The Eco-efficient City
- The Place-based City
- The Sustainable Transport City.

These city types are obviously overlapping in their approaches and outcomes, but each provides a perspective on how attempts to improve the green urbanism of a city can be achieved. While no one city has shown innovation in all seven areas, some are quite advanced in one or two. The challenge for urban professionals is to apply all of these approaches together, to generate a sense of purpose through a combination of new technology, city design and community-based innovation.

2.2.1. *The Renewable Energy City*

There are now a number of urban areas that are partly powered by renewable energy techniques and technologies, from the regional to the building level. Renewable energy enables a city to reduce its ecological footprint, and if biological fuels are used, it can be part of a city's enhanced ecological functions.

Renewable energy production can and should occur within cities, integrated into their land use and built form, and comprising a significant and important element of the urban economy. Cities are not simply consumers of energy, but catalysts for more sustainable energy paths, and can increasingly become a part of the earth's solar cycle.

While some solar city projects are underway, including Treasure Island in San Francisco, there are presently no major cities in the world that are powered entirely by renewable energy. Movement towards a renewable-energy future will require much greater commitment from cities themselves at all levels, including the local and the metropolitan.

Masdar City in the United Arab Emirates is an important first example of a city built from scratch with 100% renewable energy and zero car use (in theory). It is being built with a 60 MW solar photovoltaic plant to power all construction, and eventually a 130 MW solar photovoltaic plant for ongoing power as well as a 20 MW wind farm and geothermal heat pumps for cooling buildings. Electric automatic pod cars on an elevated structure or underground will be the basis of the transport. Masdar has begun to be built (Revkin, 2008).

North Port Quay in Western Australia is designed to be home to 10,000 households and is designed to be 100% renewable through solar photovoltaics, small wind turbines called wind pods and a nearby wave power system. The development will be dense and walkable, with an all-electric transport system featuring electric public and private transport, all linked to renewable power through battery storage in vehicles. The concept has had a mixed response and will be several years in its planning phase because such developments are not easy to accept into town planning schemes designed around fossil fuel-based development.

Urban planning is necessary to create the infrastructure needed to support solar and wind power at the scale necessary to help power a city. While finding locations for large wind farms near urban areas has been controversial (such as the wind farm proposal that was defeated off the coast of Cape Cod, Massachusetts), there are significant opportunities to harness solar and wind power. Studies are also now showing that wind, like photovoltaic solar power, can be integrated into cities and their buildings.

Hydropower has been used in cities such as Vancouver and Christchurch, New Zealand, for decades. Hydropower is growing slowly due to the impact of large dams, but geothermal power appears to be offering a similar level of base load renewable power.

New model cities that are 100% renewable are needed, but retrofitting existing cities is just as important. Cape Town is moving to become 10% renewable and Adelaide has gone from 0% to 20% renewable energy in ten years by building four large wind farms. In Europe, Freiburg and Hannover have become demonstrations on how to bring renewable energy into city planning (City of Hannover, 1998; Scheurer and Newman, 2008).

The City of Vaxja in Sweden has developed a locally based renewable energy strategy that takes full advantage of its working landscapes, in this case the abundant forests near the city. Vaxja's main power plant, formerly fueled by oil, now depends on biomass almost entirely from wood chips, most of which are a by-product of commercial logging in the region. The wood, more specifically, comes from the branches, barks and tops of trees, and is derived from within a 100 km radius of the power plant. This combined heat and power plant (Sandvik II) provides the entire town's heating needs and much of its electricity needs. Its conversion to using biomass as a fuel has been a

key element in the city's aspiration to become an oil-free city. Clearly, each city can develop its own mix of local renewable sources, but Vaxja has demonstrated that it can transition from an oil-based power system to a completely renewable system without losing its economic edge. Indeed, cities that develop such resilience early are likely to have an edge as oil resources decline.

The metropolitan landscape can be viewed as the palette for a creative mix of solar design and renewable energy projects; each city and region will have its own special opportunities and resources and in doing so will help create more resilient cities.

One of the most important potential biofuel sources of the future is blue-green algae that can be grown intensively on rooftops. Blue-green algae photosynthesize, so all that they require is sunlight, water and nutrients. The output from blue-green algae is ten times faster than most other biomass sources, so it can be continuously cropped and fed into a process for producing biofuels or small-scale electricity. Most importantly, city buildings can all use their roofs to tap solar energy for local purposes without the distribution or transport losses so apparent in most cities today. According to one advocate of this approach, "every roof should be photosynthetic", meaning a green roof for biodiversity purposes, water collection, photovoltaic collectors or biofuel algal collectors. This can become a solar ordinance set by town planners as part of local government policy.

Few cities have done much to take stock of their photosynthetic energy potential. Municipal comprehensive plans typically document and describe a host of natural and economic resources found within the boundaries of a city — from mineral sites, through historic buildings, to biodiversity — but estimating incoming renewable energy (sun, wind, wave, biomass or geothermal) is usually not included. In advancing the renewable energy agenda in Barcelona, the city took the interesting step of calculating incoming solar gain. As a former sustainable city counselor noted, this amounted to "ten times more than the energy the city consumes or 28 times more than the electricity the city is consuming" (Puig, 2005). The issue is how to tap into this across the city.

The shift in direction to a renewable city can occur through many actions: demonstration solar or low-energy homes created to show architects, developers, and citizens that green can be appealing; procurement actions that source regionally produced wind and other renewable energy to power municipal transit, lights and buildings; and

green building standards and requirements for all new public as well as private buildings.

Along with incentives (financial and otherwise), solar cities recognize the need to set minimum regulatory standards. Barcelona has a solar ordinance, which requires new buildings, and substantial retrofits of existing buildings, to obtain a minimum of 60% of hot water needs from solar. This has already led to a significant growth of solar thermal installations in that city.

Transport can also be a major part of the renewable energy challenge. The more public transport moves to electric power, the more it can be part of a renewable city. Calgary Transit's creative initiative called 'Ride the Wind' provides all the power needed for its light rail system from wind turbines in the south of Alberta, Canada. Private transport can now also be part of this transition through a combination of electric vehicles and new battery storage technology, collectively called 'Renewable Transport' (see Went *et al.*, 2008). Not only can electric vehicles use renewable electricity to power their propulsion, they can also be plugged in during the day and add to the grid through their batteries, because their power systems store four times their consumption. Thus, they can provide a critical role in enabling renewable energy to build up a much higher proportion of the urban energy grid. There is also a growing belief that natural gas, which can be created from carbon dioxide (CO_2) and sunlight, will be the renewable freight and industry fuel of the future.

Renewable power enables cities to create healthy and liveable environments while minimizing the use and impact of fossil fuels. But, by itself, this will not be enough to ensure resilient, green urban development.

2.2.2. *The Bioregional Carbon Neutral City*

Carbon neutral has become something of a rallying cry for those who want to do something about climate change. It can become the goal for all urban development, just as it has become for some local governments, businesses and households. This will require a three-step process:

- Reducing energy use wherever possible — especially in the building and transportation sectors;