

Green Urbanism and Its Application to Singapore

A Tale of Seven Green Cities

Text by Peter Newman
Images as credited

A perspective that can link the cultural dimension of Singapore with the provision of green urbanism as a source of pride and opportunity is now needed.

Cities have a new set of “wicked problems” to respond to including climate change (both carbon reduction and adaptation to climate change), rising mountains of waste, loss of biodiversity, regional self-sufficiency, local identity in a global world, and dramatically rising traffic congestion. Underneath all these are the age-old issues of the need to create a liveable city with a competitive urban economy.

Traditional disciplines and professions have not been able to provide answers to these overlapping problems, so we have provided a set of seven principles of green urbanism designed to enable cities to respond to them. We have outlined them from a global urban perspective in two recent books, one on global examples and one on Asia.¹

These principles are described as seven archetypal cities:

- the renewable energy city
- the 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 green urbanism in 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 planners 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.

Singapore is developing as something of a model in the Asian context, and illustrations of how it appears to be applying these principles will be outlined.



RENEWABLE
ENERGY
CITY



CARBON-NEUTRAL
CITY



DISTRIBUTED
CITY



BIOPHILIC
CITY



ECO-EFFICIENT
CITY



PLACE-BASED
CITY



SUSTAINABLE
TRANSPORT
CITY

2. Seven principles of green urbanism described as archetypes for cities (Illustration: Dexian Feng)

Seven Archetypes of Green Cities

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 building level. Renewable energy enables a city to reduce its ecological footprint and, if biological fuels are used, can be part of a city's enhanced ecological functions.

Renewable energy is rapidly becoming the main power source, with over 70 percent of global investment in renewables rather than coal and gas. Photovoltaic cells (PVs) with lithium-ion battery storage are now enabling cities to provide areas of self-sufficiency and, with electric vehicles plugged in, can enable 100 percent renewable lifestyles. Small-scale wind is also potentially able to assist local renewables to thrive.

Carbon-Neutral City. Carbon neutrality can become the goal for all urban development, just as it has become for some businesses and households. This will require a three-step process:

- Reducing energy use wherever possible—especially in the building and transportation sectors
- Adding as much renewable energy as possible, while being careful that the production of renewable energy is not contributing significantly to greenhouse gases
- Offsetting any carbon dioxide emitted through purchasing carbon credits, particularly through tree planting

Distributed City. The development of distributed power and water systems aims to achieve a shift from large, centralised systems to small-scale, neighbourhood-based systems in cities. The distributed use of power and water can enable a city to reduce its ecological footprint, because power and water can be more efficiently provided using the benefits of electronic control systems and community-oriented utility governance.

Over the past 100 years, most power and water systems for cities have become bigger and more centralised. Although newer forms of power and water are increasingly smaller-scale, they are often still fitted into cities as though they were large. The movement that looks at how these new technologies can be fitted into cities and decentralised across grids is called “distributed power and distributed water systems”.

Biophilic City. Biophilic cities use natural processes as part of the infrastructure and landscaping of buildings. By greening their buildings, streets, and watercourses, cities can “air-condition” the urban air (reducing the urban heat island effect), reduce the flow of stormwater in large storms, help with energy efficiency in buildings, and create new opportunities for biodiversity regeneration. The effect of this urban greening is significant for the stress reduction and emotional health of people.

A city developing the new technologies of green roofs, green balconies, and green walls benefits from the provision of a new

structural habitat that cannot be created by traditional landscaping between buildings. This is especially important in dense cities, where greenery between buildings is lacking. Greening high-rise buildings is a particularly important innovation, as it can enable dense cities to create something equivalent to the ecological structure of a forest.

Eco-Efficient City. In an effort to improve eco-efficiency, cities and regions are moving from linear to circular or closed-loop systems, where substantial amounts of their energy and material needs are provided from waste streams. Eco-efficient cities reduce their ecological footprint by reducing waste and resource requirements.

A more integrated notion of energy and water entails seeing cities as complex metabolic systems (not unlike a human body) with flows and cycles and where, ideally, the things that have traditionally been viewed as negative outputs (for example, solid waste and wastewater) are re-envisioned as productive inputs to satisfy other urban needs, including energy. For some time, the sustainability movement has been advocating this shift away from the view of cities as linear resource-extracting machines to an integrated approach of urban metabolism. This is often described as the eco-efficiency agenda.

Place-based City. Cities and regions need to compete in a global economy, but at the same time, they realise they need to develop their local economies, build a unique and special sense of place, and nurture a high quality of life with a strong commitment to community. The more place-oriented and locally self-sufficient a city's economy is, the more it will reduce its ecological footprint and the more it will ensure that its valuable ecological features are enhanced. Place-based city concepts will increasingly be the people-oriented motivation for the infrastructure decisions that are made in each of the other city types.

Sustainable Transport City. Transport is the most fundamental infrastructure of a city, because it creates the primary form of the city. Cities, neighbourhoods, and regions are increasingly being designed to use energy sparingly by offering walkable, transit-oriented options, more recently supplemented by vehicles powered by renewable energy. Cities with more sustainable transport systems have been able to increase their resilience by reducing their use of fossil fuels, urban sprawl, and dependence on car-based infrastructure.

The agenda for large cities now is to have more sustainable transport options so as to reduce traffic while reducing greenhouse gases by 50 percent by 2050 at least, in line with the global agenda set by the Intergovernmental Panel on Climate Change. Most cities are now demonstrating that intensive modes (such as rail, walking, and cycling) facilitate knowledge-economy jobs in urban centres, while dispersive modes (such as bus and cars) only enable the consumer economy. Thus there is a new competitive edge to those cities that can reduce their automobile dependence.



3



4



5

1. Singapore in 1986 and 2007 showing an increase in canopy cover (Image: National Parks Board).

3. Heritage roads (Arcadia Road pictured) have complete canopy covers (Photo: National Parks Board).

4. Concrete from an old canal is recycled into the new Kallang River @ Bishan-Ang Mo Kio Park, which was designed based on the ABC Waters Design Guidelines principles (Photo: Peter Newman).

5. The government is committed to making offshore island Pulau Ubin carbon-neutral. Small-scale distributed infrastructure is also being experimented there (Photo: alex.ch/ Flickr/ CC BY 2.0).

Application to Singapore

Renewable Energy City. While Singapore is not a world leader in renewable energy applications, PV has grown rapidly in Singapore (from a capacity of 50 kilowatts in 2007 to 2,000 kilowatts in 2009), with government demonstration programmes worth S\$68 million applied to commercial projects (Building and Construction Authority's Zero Energy Building is exemplary) and residential projects (Housing and Development Board has 30 solar precincts planned by 2015). Two shopping centres have also declared that they will be solar. Singapore is becoming the solar hub of Asia in terms of PV production (Renewable Energy Corporation can produce 740 megawatts of PV and has created 5000 jobs) and installation (Conergy and Solar World Asia are headquartered in Singapore).

Carbon-Neutral City. Carbon-neutral strategies are beginning to take shape in Singapore. The city is keen to show in international forums that its carbon dioxide emissions per dollar of gross national product is declining steadily. However, its total emissions of carbon dioxide continue to rise. There are early innovators that have committed to being carbon-neutral within the tourism and commerce sectors. They include Alila Hotels and Resorts and the condominium, 11 Tampines Concourse, by City Developments Limited. The government is also committed to making offshore island Pulau Ubin carbon-neutral. A carbon plan is needed for Singapore and its neighbours, which might encourage Indonesia to burn or clear less forest. Other innovations could come from pledges or declarations of carbon-neutrality by the whole tourism industry or Central Business District to attract green business to relocate themselves there. Most radical of all, the Port of Singapore Authority could move to using biofuels for its bunker fuel in order to be more carbon-neutral.

Distributed City. Distributed infrastructure strategies require a polycentric city urban form to work best, and Singapore has that, with its 22 separate sub-centres. It also has 5 districts with a rudimentary governance structure administered by Community Development Councils that could enable small-scale energy, water, and waste systems to flourish. These have not been considered before, because Singapore is one of the few Asian cities to have a fully sewerage city, fully reticulated water supply system, and complete grid for electricity covering all buildings. However, as small-scale systems for water, energy, and waste become more mature, it will be possible to put these back into the city while retaining the central grids for back-up. Singapore's design for the Tianjin Eco City in China was based on a distributed system of infrastructure. New housing developments like Punggol are experimenting with some smaller-scale infrastructure, as are Pulau Ubin, Pulau Tekong, and Changi Naval Base. Singapore enjoys an advantage of having the necessary smart control systems through its electricity and information and communications technology systems that can enable distributed systems to work.

Biophilic City. Biophilic strategies are well underway in Singapore, through some of the best landscaping examples in tropical Asia and through some of the innovative architecture of people like Ken Yeang. The new ethos is to move from a "garden city" to a "city in a garden". This is being done through a combination of strategies including: the Skyrise Greenery initiative, which has given subsidies for roof and wall greening as well as balcony gardens and has provided handbooks on how to implement them; the Streetscape Greenery Master Plan, which is complemented by heritage roads with complete canopy covers and heritage tree programmes; the Hort Park, which showcases green roofs and walls; the Active Beautiful Clean (ABC) Waters Design Guidelines, which set out the principles of water-sensitive urban design and how to design constructed wetlands or drains that are green rather than concrete; and the Park Connector Network, which drives green connections across the city along with tree top walks. In global terms, Singapore is probably the leader in biophilic urbanism.

Eco-Efficient City. Singapore's eco-efficiency strategy is also one of the best in the world. In energy efficiency, the city has a full strategy with grants for research and development and training for each sector. The waste system is exemplary, with almost 100 percent of construction waste being recycled. Organic fractions are used for power production, and nearly every waste stream is extracted before a small stream of final waste is landfilled. The city is now a leader in recycling sewage back into its supply of potable water, and almost all rainfall and stormwater is collected in reservoirs. Industrial waste is minimised, but an industrial ecology process could be established and has been suggested for Jurong, especially if Singapore shifts to being a major producer of biofuels based on palm oil and sea algae.


Place-based City. Strategies of sense of place, to ensure the human dimension of green urbanism, are apparent in Singapore. Its polycentric urban form has meant that each centre has been given a distinct identity and has the core functions of schools, shops (including a traditional wet market and hawker centre), a library, health care, and other government services. The Housing and Development Board quota system ensures that each block of apartments reflects a cross section of the population rather than a social ghetto. The environmental identity is well established, through access to most water and park areas. Cultural icons such as the Singapore riverfront have been restored for popular enjoyment (complete with sculptures and story boards). Urban design and development are constantly being re-evaluated in terms of their cultural relevance and contribution to the "tropical island of excellence". A perspective that can link the cultural dimension of Singapore with the provision of green urbanism as a source of pride and opportunity is now needed. Gardens by the Bay is an internationally important example of place-based biophilic urbanism.



Sustainable Transport City. Sustainable transport strategies are one of the great contributions of Singapore to the global transport and land-use debate, especially in the Asian region. Singapore has been able to create first, quality transit down each main corridor that is faster than traffic and second, dense transit-oriented developments built around each station. However, pedestrian and bicycle strategies have not been as high a priority as they perhaps deserve; instead, tremendous effort has gone into managing congestion in the city. Plug-in infrastructure for electric vehicles has begun to be considered and is an obvious next step for the city's innovation. A growth boundary around the city preventing further urban encroachment is constantly managed as the city has so little land. Thus it has been a model for many cities trying to struggle with their sprawl. Densities have however been reducing and need to be watched, as most sustainable transport systems work better with density.



Conclusion

Green urbanism for the city of the future is becoming an agenda that cannot be neglected as global concerns of climate change, peak oil, water, waste, biodiversity, and urban quality of life accelerate. Green urbanism offers ways of solving all these problems together. There will need to be infrastructure to support the seven city types outlined if any city is to respond to these concerns. Examples have been provided of how each agenda is underway; however, no city has begun to work equally on all seven areas. Eventually this will be required. Singapore has shown leadership in the Asian region on some of these issues, but for it to continue to be a twenty-first-century model, it will need to adopt some of these emerging paradigms more extensively. This is a challenge but it is also a great opportunity. 

- ¹ Peter Newman, Timothy Beatley, and Heather M. Boyer, *Resilient Cities: Responding to Peak Oil and Climate Change* (Washington, DC: Island Press, 2009); and Peter Newman and Anne Matan, *Green Urbanism in Asia* (Singapore: World Scientific, 2013).

6. Green views at Khoo Teck Puat Hospital (Photo: Peter Newman).

7. Inside the façade of 158 Cecil Street (Photo: Peter Newman).