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Green Urbanism: Formulating a Series of Holistic Principles

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Views

Green Urbanism: Formulating a Series of Holistic Principles

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Abstract

New Urbanism
New Urbanism is an urban design movement, which arose in the USA in the early 1980s, promoting walkable, mixed-use neighbourhoods and transit-oriented development, seeking to end suburban sprawl and promote community. Characteristics include narrow streets, wide sidewalks and higher densities, qualities which we can all find in the European cities.

Green Urbanism
Green Urbanism is a conceptual model for zero-emission and zero-waste urban design, which arose in the 1990s, promoting compact energy-efficient urban development, seeking to transform and re-engineer existing city districts and regenerate the post-industrial city centre. It promotes the development of socially and environmentally sustainable city districts.

This paper will first look at the timeline of important publications that have been published on sustainable design and have emerged from different schools of thought, to exemplify how gradually the notion of Green Urbanism *evolved. It then identifies the intertwined principles for achieving* Green Urbanism.

Keywords: Urban design, holistic approaches, green urbanism, low carbon city, zero carbon city, compact community.

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1. THE ORIGINS OF GREEN URBANISM

1.1 DIFFERENT SCHOOLS OF THOUGHT: FROM DISTRICTS TO GREEN CITY

Over the last thirty-five years or so, an international debate on eco-city theory has emerged and has developed as a relevant research field concerning the future of urbanism and the city itself. During that time, a number of architectural schools of thought have been implemented worldwide. One such school is *Technical Utopianism* (a technological idealism that relied on the quick 'techno-fix', as expressed, for instance, in the work of Archigram). Other early writing on green urbanism was available from Ebenezer Howard, whose 1902 book was entitled 'Garden City of Tomorrow', and whose political and social agenda has recently made a comeback. Much later, in 1969, Reyner Banham pioneered the idea that technology, human needs and environmental concerns should be considered an integral part of architecture. Probably no historian before him had so systematically explored the impact of environmental engineering and services on the design of buildings (Howard, 1902; Banham, 1969). Some other early significant writing on green urbanism has come from Lewis Mumford and Jane Jacobs – although they didn't call it green urbanism. From 'Silent Spring' (by Rachel Carson, 1962), to Victor Olgyay's 'Design with Climate' (1963), to Reyner Banham's 'Architecture of the Well-tempered Environment' (1969), to Ian McHarg's 'Design with Nature' (1969), to the pivotal publications by authors re-connecting urbanism with the climatic condition (such as Koenigsberger, Drew and Fry, or Szokolay, in publications in the 1970s and 80s), to the remarkable 'Brundtland Report' (Brundtland, 1987); the important contributions from Robert and Brenda Vale ('Green Architecture: Design for an Energy-conscious Future', 1991), and the 'Solar City Charter' (Herzog *et al*, 1995/2007), the field of sustainable city theories and climate-responsive urbanism has constantly been expanded. An important contribution came from Guenther Moewes with his book 'Weder Huetten noch Palaeste' (1995), which is a programmatic manifesto for designing and constructing longer-lasting buildings. More recent theories for 'Compact Cities' and 'Solar Cities' (Burton, 1997; Jenks and Burgess, 2000; Lehmann, 2005) encapsulate the visions based on the belief that urban revitalization and the future of the city can only be achieved through 're-compacting' and using clearly formulated sustainable urban design principles. These principles for achieving green urbanism have to be clearly defined and adjusted to an era of rapid urbanization, especially in the Asia-Pacific Region. In the 21st century we are working in an entirely new context, for which we need new types of cities. As noted by Ulrich Beck, we have arrived in 'a new era of uncertainty', where energy, water and food supply are critical. 'We live in a world of increasingly non-calculable uncertainty that we create with the same speed of its technological developments' (Beck, 2000).

In 1972, the *Club of Rome* formulated, in its study 'Limits of Growth', the negative effect of sprawl and over-consumption of resources. Today, we know that uncontrolled development is a damaging exercise, and that urban growth should occur in existing city areas rather than on greenfield sites. Portland (Oregon, USA) was well ahead of most other cities when, in the early 1980s, it introduced a legally binding 'growth boundary' to stop sprawl and the emptying-out of its downtown area. 'Today, younger people don't desire to live in the endless suburbs anymore, but have started to re-orientate themselves back to the city core, mainly for lifestyle reasons' (Fishman, 1987). However, as several recent studies of inner-city lifestyles reveal, an increase in consumption can be part of the inner-city renaissance, which often enlarges the ecological footprint of the urban dweller (e.g. research by the Universities of Vancouver and Sydney on the effect of higher population density and increase in lifestyle gadgets owned by urban dwellers).

At the end of the 20th century, Tokyo, Sao Paulo, Mexico-City, Mumbai, Calcutta, Shanghai and Beijing have grown to become endless urban landscapes. They are new types of mega-cities, which express an impossibility of orderly planning and strategic regulation. In his 1996 essay, Rem Koolhaas rightly asked 'What ever happened to urbanism?'.We find emerging *Green Urbanism* theory for the 21st century, which aims to transform existing cities from fragmentation to compaction. Eco-city theory focuses on adjusting the relationship between city and nature. Leading sociologists and urban theorists, including Ulrich Beck, Saskia Sassen, Richard Sennett, Jan Gehl, Manuel Castells, Anthony Giddens, Herbert Girardet, Thomas Sieverts, to name just a few, are exploring wider areas such as globalization, urban sustainability, ecology, network systems, information and communication technologies, and other related fields. Federico Butera, Ken Yeang, Richard Burdett, Jaime Lerner and Jeffrey Kenworthy also made some important contributions to the discussion of sustainable urban planning. Solar cities in Linz-Pichling (Austria), Freiburg-Vauban and the Solar District Freiburg-Schlierberg (Germany), Hanover-Kronsberg (Germany), Stockholm Hammarby-Sjöstad (Sweden), the *BedZED Development* in Sutton (South of London, UK), and the green district EVA Lanxmeer in Culemborg (The Netherlands) represent some of the built milestones in sustainable urban development at the beginning of the 21st century. The Swedish city of Vaexjö has been very successful in reducing its CO_2 emissions and will be, by 2015, entirely independent from fossil fuels. The industrial park in Kalundborg (Denmark) is often cited as a model for industrial ecology, while the city of Waitakere, in the Western part of the greater Auckland urban region, is New Zealand's first eco-city. More recently, excellent compilations of research on sustainable cities have been published by Satterthwaite, Wheeler and Beatley. In the meantime, 'Sustainability Science' has emerged as a conceptual and theoretical basis for a new planning paradigm. Today, we can probably recognize two major breaks in the continuous development of cities. The first is connected to the introduction of the automobile, which made possible an entirely different, dispersed city model (the de-compacted 'Functional City' of the 20th century). The second, the full awareness of problems posed by climate change and consumption of fossil fuel, is of equal importance and just as far-reaching, raising the possibility of entirely new city models and typologies that are likely to emerge: Green Urbanism. (Lehmann, 2010)

Cities can and must become the most environmentally-friendly model for inhabiting our earth.

It is more important than ever to re-conceptualize existing cities and their systems of infrastructure, to be compact, mixed-use and polycentric cities.

2. FORMULATING THE PRINCIPLES OF GREEN URBANISM

Green Urbanism is by definition interdisciplinary; it requires the collaboration of landscape architects, engineers, urban planners, ecologists, transport planners, physicists, psychologists, sociologists, economists and other specialists, in addition to architects and urban designers. *Green Urbanism* makes every effort to minimize the use of energy, water and materials at each stage of the city's or district's life-cycle, including the embodied energy in the extraction and transportation of materials, their fabrication, their assembly into the buildings and, ultimately, the ease and value of their recycling when an individual building's life is over. Today, urban and architectural design also has to take into consideration the use of energy in the district's or building's maintenance and changes in its use; not to mention the primary energy use for its operation, including lighting, heating and cooling.

2.1 ENERGY, WATER AND FOOD SECURITY

This part introduces the *15 Principles of Green Urbanism* as a conceptual model and as a framework for how we might be able to tackle the enormous challenge of transforming existing neighbourhoods, districts and communities, and how we can re-think the way we design, build and operate in future our urban settlements. These principles are partly universal, but there is no one single formula that will always work. To achieve more sustainable cities, urban designers must understand and apply the core principles of *Green Urbanism* in a systematic and adapted way. These principles can be effective in a wide variety of urban situations, but they almost always need to be adapted to the context and the project's scale, to the site's constraints and opportunities. We need to develop a specific approach for each unique site and situation, adapting the principles to the particular climatic conditions, site context, availability of technology, social conditions, project scale, client's brief, diverse stakeholder organizations, and so on. It is an approach to urban design that requires an optimization process and a solid understanding of the development's wider context and its many dimensions before the designer can produce an effective design outcome.

With all this technological progress, we should not lose sight of the fact that a key component in any society's sustainability is more than its carbon footprint.

The future of our societies is not just merely a technical matter of finding more eco-friendly energy solutions, but a question of holistic environmental and social sustainability and identifying principles for healthy communities.

2.2 SOCIAL SUSTAINABILITY AND A HEALTHY COMMUNITY NEED TO BE PART OF ANY VISION OF THE FUTURE

The districts and cities where the *Principles of Green Urbanism* have been applied and integrated in every aspect are urban environments that:

- respond well to their climate, location, orientation and context, optimizing natural assets such as sunlight and wind flow,
- are quiet, clean and effective, with a healthy microclimate,
- have reduced or have no CO_2 emissions, as they are self-sufficient energy producers, powered by renewable energy sources,
- eliminate the concept of waste, as they are based on a closed-loop ecosystem with significant recycling, reusing, remanufacturing and composting,

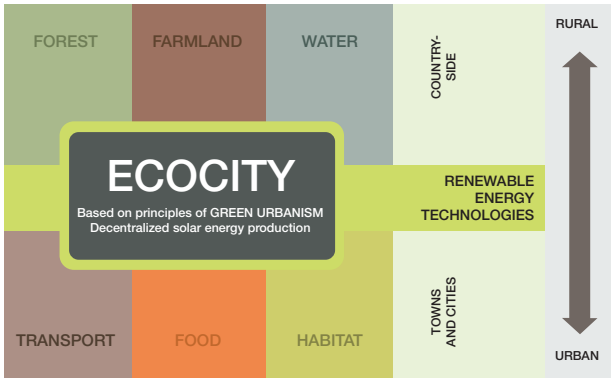

Figure 1. Above: The three pillars of Green Urbanism, and the interaction between these pillars. Below: The holistic concept of Eco-City has again a balanced relationship between the urban area (city) and the rural area (countryside). Both diagrams by Steffen Lehmann, 2005/2010.

- have high water quality, practicing sensitive urban water management,
- integrate landscape, gardens and green roofs to maximize urban biodiversity and mitigate the urban heat island effect,
- take only their fair share of the earth's resources, using principles of urban ecology,
- apply new technologies such as co-generation, solar cooling and electric-mobility,
- provide easy accessibility and mobility, are well inter-connected, and provide an efficient low-impact public transport system,
- use regional and local materials and apply prefabricated modular construction systems,
- create a vibrant sense of place and authentic cultural identity, where existing districts are densified and make use of urban mixed-use infill projects,
- are generally more compact communities around transport nodes ('green Transit-Oriented Developments, TODs'), with a special concern for affordable housing and mixed-use programs,
- use deep green passive design strategies and solar architecture concepts for all buildings, with compact massing for reduced heat gain in summer,
- are laid-out and oriented in a way that keeps the buildings cool in summer, but which catches the sun in winter,
- have a local food supply through community gardens and urban farming and which achieve high food security and reduced 'food miles', and
- use multi-disciplinary approach, best practice for urban governance and sustainable procurement methods. (Lehmann, 2009)

All these criteria make it clear that our design focus should be on the neighbourhood and district scale, with projects on urban infill or redevelopment (brownfield) sites, adjacent to existing developed areas and transport nodes (avoiding further greenfield sites or master planned developments in non-urban areas). The following *Principles of Green Urbanism* were developed to further flesh-out these ideas.

3. THE 15 GUIDING PRINCIPLES OF GREEN URBANISM

The following is a short list of the principles **for local action and a more integrated approach to urban development**; for full discussion, see my book 'The Principles of Green Urbanism. Transforming the City for Sustainability' (2010). It must be noted, though, that in order to enable sustainable urban development and to ensure that eco-districts are successful on many levels, all urban design components need to work interactively and cannot be looked at separately. The principles are based on the triple-zero framework (triple-bottom line) of:

- zero fossil-fuel energy use
- zero waste
- zero emissions (aiming for low-to-no-carbon emissions).

'Zero waste' means that buildings are fully demountable and fully recyclable at the end of their life-cycle, so that the site can return to being a greenfield site after use. Understandably, it requires a holistic approach to put the principles in action and to guide the available know-how to the advantage of the city. The principles describe the strategies necessary for eco-districts, although they need to be adapted to the location, context and scale of the urban development. It may be difficult at first to achieve some of the principles, but all are important; they can potentially save money, reach early payback, improve livability and increase opportunities for social interaction of residents. The principles offer practical steps on the path to sustainable cities, harmonizing growth and usage of resources. The truly 'carbon-neutral' city has not yet been built, but all projects in this direction are important steps towards turning the vision into a reality.

The sustainability matrix – the *15 Principles of Green Urbanism* – consists of:

3.1 PRINCIPLE 1: CLIMATE AND CONTEXT

The city based on its climatic conditions, with appropriate responses to location and site context. What are the unique site constraints, climatic conditions and opportunities?

Every site or place has its own unique individual conditions in regard to orientation, solar radiation, rain, humidity, prevailing wind direction, topography, shading, lighting, noise, air pollution and so on. The various aspects of this principle include: Climatic conditions, which are seen as the fundamental influence for form-generation in the design of any project; understanding the site and its context, which is essential at the beginning of every sustainable design project; optimizing orientation and compactness to help reduce the city district's heat gain or losses; achieving a city with minimized environmental footprint by working with the existing landscape, topography and resources particular to the site, and the existing micro-climate of the immediate surroundings. Maintaining complexity in the system is always desirable (be it biodiversity, eco-system or neighbourhood layout), and a high degree of complexity is always beneficial for society. Enhancing the opportunities offered by topography and natural setting leads to a city well adapted to the local climate and its eco-system. We can use the buildings' envelope to filter temperature, humidity, light, wind and noise. Due to the different characteristics of every location, each city district has to come up with its own methods and tailored strategies to reach sustainability and to capture the spirit of the place. Each site or city is different and the drivers for re-engineering existing districts will need to understand how to take full advantage of each location's potential, and how to fine-tune the design concept to take advantage of local circumstances. As an aim, all urban development must be in harmony with the specific characteristics, various site factors and advantages of each location and be appropriate to its societal setting and contexts (cultural, historical, social, geographical, economical, environmental and political). In future, all buildings will have

climate-adapted envelope technologies, with facades that are fully climate-responsive.

3.2 PRINCIPLE 2: RENEWABLE ENERGY FOR ZERO CO_2 EMISSIONS

The city as a self-sufficient on-site energy producer, using decentralized district energy systems. How can energy be generated and supplied emission-free and in the most effective way?

The various aspects of this principle include: Energy supply systems and services, as well as energy efficient use and operation, promoting increased use of renewable power, and perhaps natural gas as a transition fuel in the energy mix, but always moving quickly away from heavy fossil-fuels such as coal and oil; and the transformation of the city district from an energy consumer to an energy producer, with local solutions for renewables and the increasing de-carbonizing of the energy supply. The supply of oil will last shorter than the life-expectancy of most buildings. The local availability of a renewable source of energy is the first selection criteria for deciding on energy generation. In general, a well-balanced combination of energy sources can sensibly secure future supply. A necessary aim is also to have a distributed energy supply through a decentralized system, utilizing local renewable energy sources. This will transform city districts into local power stations of renewable energy sources, which will include solar PV, solar thermal, wind (on- and off-shore), biomass, geothermal power, mini-hydro energy and other new technologies. Some of the most promising technologies are in building-integrated PV, urban wind turbines, micro CHP and solar cooling. That is to say, there should be on-site electrical generation and energy storage in combination with a smart grid, which integrates local solar and wind generation, utilizing energy-efficiency in all its forms. Solar hot water systems would be compulsory. Co-generation technology utilizes waste heat through CHP combined-heat-and-power plants. Energy-efficiency programs are not enough. Too often we find that savings from energy-efficiency programs are absorbed by a rise in energy use. Genuine action on climate change means that coal-fired power stations cease to operate and are replaced by renewable energy sources. Eco-districts will need to operate on renewable energy sources as close to 100 per cent as possible. As a minimum, at least 50 per cent of on-site renewable energy generation should be the aim of all urban planning, where the energy mix comes from decentralized energy generation and takes into account the resources that are locally available, as well as the cost and the availability of the technology. Optimizing the energy balance can be achieved by using exchange, storage and cascading (exergy) principles. It is, therefore, essential that the fossil-fuel powered energy and transportation systems currently supporting our cities are rapidly turned into systems that are supplied by renewable energy sources. High building insulation, high energy-efficiency standards and the use of smart metering technology is essential, so that if a part of an office building is not in use, the intelligent building management system will shut down lights and ventilation.

3.3 PRINCIPLE 3: ZERO-WASTE CITY

The zero-waste city as a circular, closed-loop eco-system. How to avoid the creation of waste in the first place – changing behaviour of consumption?

Sustainable waste management means to turn waste into a resource. All cities should adopt nature's zero-waste management system. Zero-waste urban planning includes reducing, recycling, reusing and composting waste to produce energy. All material flows need to be examined and fully understood, and special attention needs to be given to industrial waste and e-waste treatment. We need to plan for recycling centres, for zero landfill and 'eliminating the concept of waste' and better understanding nutrient flows (Braungart, 2002). Eco-districts are neighbourhoods where we reuse and recycle materials and significantly reduce the volume of solid waste and toxic chemical releases. All construction materials as well as the production of goods (and building components) need to be healthy and fully-recyclable. Waste prevention is always better than the treatment or cleaning-up after waste is formed. Some other systems that need to be put in place are: the remanufacturing of metals, glass, plastics, paper into new products needs to be a routine (without down-grading the product); waste-to-energy strategies are needed for residual waste; and an 'extended producer responsibility' clause is needed for all products. In this context of waste, better management of the nitrogen cycle has emerged as an important topic: to restore the balance to the nitrogen cycle by developing improved fertilization technologies, and technologies in capturing and recycling waste. Controlling the impact of agriculture on the global cycle of nitrogen is a growing challenge for sustainable development. Essentially, we need to become (again) a 'recycling society', where it is common that around 60 to 90 per cent of all waste is recycled and composted.

3.4 PRINCIPLE 4: WATER

The city with closed urban water management and a high water quality. What is the situation in regard to the sustainable supply of potable drinking water?

The various aspects of this principle include, in general, reducing water consumption, finding more efficient uses for water resources, ensuring good water quality and the protection of aquatic habitats. The city can be used as a water catchment area by educating the population in water efficiency, promoting rainwater collection and using wastewater recycling and storm water harvesting techniques (e.g. solar-powered desalination plants). Storm water and flood management concepts need to be adopted as part of the urban design, and this includes storm water run-offs and improved drainage systems and the treatment of wastewater. As part of the eco-district's adequate and affordable health care provisions, it needs to ensure the supply of safe water and sanitation. This includes such things as algae and bio-filtration systems for grey water and improving the quality of our rivers and lakes so that they are fishable and swimmable again. An integrated urban water cycle planning and management system that includes

a high-performance infrastructure for sewage recycling (grey and black water recycling), storm water retention and harvesting the substantial run-off through storage, must be a routine in all design projects. On a household level we need to collect rain water and use it sparingly for washing and install dual-water systems and low-flush toilets. On a food production level we need to investigate the development of crops that need less water and are more drought resistant.

3.5 PRINCIPLE 5: LANDSCAPE, GARDENS AND URBAN BIODIVERSITY

The city that integrates landscapes, urban gardens and green roofs to maximize biodiversity. Which strategies can be applied to protect and maximize biodiversity and to re-introduce landscape and garden ideas back in the city, to ensure urban cooling?

A sustainable city takes pride in its many beautiful parks and public gardens. This pride is best formed through a strong focus on local biodiversity, habitat and ecology, wildlife rehabilitation, forest conservation and the protecting of regional characteristics. Ready access to these public parks, gardens and public spaces, with opportunities for leisure and recreation, are essential components of a healthy city. As is arresting the loss of biodiversity by enhancing the natural environment and landscape, and planning the city using ecological principles based on natural cycles (not on energy-intensive technology) as a guide, and increasing urban vegetation. A city that preserves and maximizes its open spaces, natural landscapes and recreational opportunities is a more healthy and resilient city. The sustainable city also needs to introduce inner-city gardens, urban farming/agriculture and green roofs in all its urban design projects (using the city for food supply). It needs to maximize the resilience of the eco-system through urban landscapes that mitigate the 'urban heat island' (UHI) effect, using plants for air-purification and urban cooling. Further, the narrowing of roads, which calms traffic and lowers the UHI effect, allows for more (all-important) tree planting. Preserving green space, gardens and farmland, maintaining a green belt around the city, and planting trees everywhere (including golf courses), as trees absorb CO_2, is an important mission. As is conserving natural resources, respecting natural energy streams and restoring stream and river banks, maximizing species diversity. At home, we need to de-pave the driveway or tear up parking lots. In all urban planning, we need to maintain and protect the existing eco-system that stores carbon (e.g. through a grove or a park), and plan for the creation of new carbon storage sites by increasing the amount of tree planting in all projects. The increase in the percentage of green space as a share of total city land is to be performed in combination with densification activities.

3.6 PRINCIPLE 6: SUSTAINABLE TRANSPORT AND GOOD PUBLIC SPACE: COMPACT AND POLY-CENTRIC CITIES

The city of eco-mobility, with a good public space network and an efficient low-impact public transport system for post-fossil-fuel mobility. How can we get people out of their cars, to walk, cycle, and use public transport?

Good access to basic transport services is crucial, as it helps to reduce automobile dependency, as does reducing the need to travel. We need to see integrated non-motorized transport, such as cycling or walking, and, consequently, bicycle/pedestrian-friendly environments, with safe bicycle ways, free rental bike schemes and pleasant public spaces. It is important to identify the optimal transport mix that offers inter-connections for public transport and the integration of private and public transport systems. Some ideas here include: eco-mobility concepts and smart infrastructure (electric vehicles); integrated transport systems (bus transit, light railway, bike stations); improved public space networks and connectivity, and a focus on transport-oriented development ('green TODs'). It is a fact that more and wider roads result in more car and truck traffic, and CO_2 emissions, and also allows for sprawling development and suburbs that increases electricity-demand and provides less green space. The transport sector is responsible for causing significant greenhouse-gas emissions (over 20 per cent). To combat this effect we need to change our lifestyles by, for example, taking public transport, driving the car less, or car-pooling. Alternatively, we can ride a bike or walk, if the city district has been designed for it. Personal arrangements have the potential to reduce commuting and to boost community spirit. We want a city district which is well-connected for pedestrians, a city with streetscapes that encourage a healthy, active lifestyle and where residents travel less and less by car. 'Green TODs' are the future, as these developments can create a range of medium-density housing typologies and provide a variety of transportation choices, achieving a balance of residences and employment.

3.7 PRINCIPLE 7: LOCAL AND SUSTAINABLE MATERIALS WITH LESS EMBODIED ENERGY

City construction using regional, local materials with less embodied energy and applying prefabricated modular systems. What kind of materials are locally available and appear in regional, vernacular architecture?

The various aspects of this principle include: advanced materials technologies, using opportunities for shorter supply chains, where all urban designs focus on local materials and technological know-how, such as regional timber in common use. Affordable housing can be achieved through modular prefabrication. Prefabrication has come and gone several times in modern architecture, but this time, with closer collaboration with manufacturers of construction systems and building components in the design phase, the focus will be on sustainability. We need to support innovation and be aware of sustainable production and consumption, the embodied energy of materials and the flow of energy in closing life-cycles. We need to emphasize green manufacturing and an economy of means, such as process-integrated technologies that lead to waste reduction. It is more environmentally friendly to use lightweight structures, enclosures and local materials with less embodied

energy, requiring minimal transport. We need improved material and system specifications, supported by research in new materials and technological innovation; reduced material diversity in multi-component products to help facilitate the design for resource recovery, disassembly, value retention, and the possibility of reusing entire building components. Success in this area will increase the long-term durability of buildings, reduce waste and minimize packaging.

3.8 PRINCIPLE 8: DENSITY AND RETROFITTING OF EXISTING DISTRICTS

The city with retrofitted districts, urban infill, and densification/intensification strategies for existing neighbourhoods. What are the opportunities to motivate people to move back to the city, closer to workplaces in the city centre?

The various aspects of this principle include: encouraging the densification of the city centre through mixed-use urban infill, centre regeneration and green TODs; increasing sustainability through density and compactness (compact building design means developing buildings vertically rather than horizontally); promoting business opportunities around green transit-oriented developments; optimizing the relationship between urban planning and transport systems; retrofitting inefficient building stock and systematically reducing the city district's carbon footprint. Consideration will need to be given to better land-use planning to reduce the impact of urban areas on agricultural land and landscape; to increasing urban resilience by transforming city districts into more compact communities and designing flexible typologies for inner-city living and working. Special strategies for large metropolitan areas and fast-growing cities are required. Here, examples of rapid development are being provided by Asian cities. Special strategies are also needed for small and medium-sized towns due to their particular milieu, and creative concepts are needed for the particular vulnerabilities of Small Island States and coastal cities. Public space upgrading through urban renewal programs will bring people back to the city centre. This will need some strategic thinking about how to use brownfield and greyfield developments and also the adaptive reuse of existing buildings. Remodeling and re-energizing existing city centres to bring about diverse and vibrant communities requires people to move back into downtown areas. This can be achieved through mixed-use urban infill projects, building the 'city above the city' by converting low density districts into higher density communities; and by revitalizing underutilized land for community benefit and affordable housing. In the compact city, every neighbourhood is sustainable and self-sufficient; and uses Energy Services Company principles for self-financing energy efficiency and in all retrofitting programs.

3.9 PRINCIPLE 9: GREEN BUILDINGS AND DISTRICTS, USING PASSIVE DESIGN PRINCIPLES

The city that applies deep green building design strategies and offers solar access for all new buildings. How can we best apply sustainable design and passive design principles in all their forms and for all buildings?

The various aspects of this principle include: low-energy, zero-emission designs, applying best practice for passive design principles, for all buildings and groups of buildings; dramatically reducing building energy use; introducing compact solar architecture; and renovating and retrofitting the entire building stock. New design typologies need to be developed at low cost, and we need to produce functionally neutral buildings that last longer. We need to apply facade technology with responsive building skins for bio-climatic architecture, to take advantage of cooling breezes and natural cross-ventilation, maximizing cross-ventilation, day-lighting and opportunities for night-flush cooling; we need to focus on the low consumption of resources and materials, including the reuse of building elements; and design for disassembly. Other ideas include: mixed-use concepts for compact housing typologies; adaptive reuse projects that rejuvenate mature estates; solar architecture that optimizes solar gain in winter and sun shading technology for summer, catching the low winter sun and avoiding too much heat gain in summer. It is important to renew the city with energy-efficient green architecture, creating more flexible buildings of long-term value and longevity. Flexibility in plan leads to a longer life for buildings. Technical systems and services have a shorter life-cycle. This means, first of all, applying technical aids sparingly and making the most of all passive means provided by the building fabric and natural conditions. Buildings that generate more energy than they consume, and collect and purify their own water, are totally achievable. We need to acknowledge that the city as a whole is more important than any individual building.

3.10 PRINCIPLE 10: LIVABILITY, HEALTHY COMMUNITIES AND MIXED-USE PROGRAMS

The city with a special concern for affordable housing, mixed-use programs, and a healthy community. How does urban design recognize the particular need for affordable housing, to ensure a vibrant mix of society and multi-functional mixed-use programs?

Land use development patterns are the key to sustainability. A mixed-use (and mixed-income) city delivers more social sustainability and social inclusion, and helps to repopulate the city centre. Demographic changes, such as age, are a major issue for urban design. It is advantageous for any project to maximize the diversity of its users. Different sectors in the city can take on different roles over a 24 hours cycle; for example, the Central Business District is used for more than just office work. In general we want connected, compact communities, for a livable city, applying mixed-use concepts and strategies for housing affordability, and offering different typologies for different housing needs. To this end we need affordable and livable housing together with new flexible typologies for inner-city living. These mixed-use neighbourhoods (of housing types, prices and ownership forms) have to avoid gentrification and provide affordable housing with districts inclusive for the poor and the

rich, young and old, and workers of all walks of life, and also provide secure tenure (ensuring 'aging in place'). Housing typologies need to deal with demographic changes. We have to understand migration and diversity as both an opportunity and a challenge. Mixed land uses are particularly important as it helps reduce traffic. Master plans should require all private developments to contain 40 to 50 per cent of public (social) housing, and have it integrated with private housing. Higher densities should centre on green TODs. Essentially, these changes will aim to introduce more sustainable lifestyle choices, with jobs, retail, housing and a city campus being close by with IT and tele-working from home significantly helping to reduce the amount of travel (motto: 'Don't commute to compute'). By integrating a diverse range of economic and cultural activities, we avoid mono-functional projects, which generate a higher demand for mobility. Green businesses would be supported through the use of ethical investments to generate funding. The question is: how specific or adaptable should buildings be to their use?

3.11 PRINCIPLE 11: LOCAL FOOD AND SHORT SUPPLY CHAINS

The city for local food supply, with high food security and urban agriculture. Which strategies can be applied to grow food locally in gardens, on roof tops and on small spaces in the city?

The various aspects of this principle include: local food production; regional supply; an emphasis on urban farming and agriculture, including 'eat local' and 'slow food' initiatives. The sustainable city makes provision for adequate land for food production in the city, a return to the community and to the allotment gardens of past days, where roof gardens become an urban market garden. It is essential that we bridge the urban-rural disconnect and move cities towards models that deal in natural eco-systems and healthy food systems. The people of the eco-city would garden and farm locally, sharing food, creating compost with kitchen scraps and garden clippings and growing 'community' vegetables. Buying and consuming locally will be necessary to cut down on petrol-based transport. Such things as re-using paper bags and glass containers, paper recycling and the cost of food processing will need reconsideration. We will need to reduce our consumption of meat and other animal products, especially shipped-in beef, as the meat cycle is very intensive in terms of energy and water consumption and herds create methane and demand great quantities of electricity. Perhaps as much as 50 per cent of our food will need to be organically produced, without the use of fertilizers or pesticides made from oil, and grown in local allotments.

3.12 PRINCIPLE 12: CULTURAL HERITAGES, IDENTITY AND SENSE OF PLACE

The city of public health and cultural identity: a safe and healthy city, which is secure and just. How to maintain and enhance a city's or region's identity, unique character and valued urban heritage, avoiding interchangeable design that makes all cities look the same?

All sustainable cities aim for air quality, health and pollution reduction, to foster resilient communities, to have strong public space networks and modern community facilities. This is the nature of sustainable cities. However, each city has its own distinct environment, whether it be by the sea, a river, in a dessert, a mountain; whether its climate is tropical, arid, temperate, etc, each situation is unique. The design of the city will take all these factors into consideration, including materials, history and population desires. The essence of place is the up-swelling of grassroots strategies, the protection of its built heritage and the maintenance of a distinct cultural identity, e.g. by promoting locally owned businesses, supporting creativity and cultural development. New ideas require affordable and flexible studio space in historic buildings and warehouses. Cities will grow according to the details and unique qualities of localities, demographic qualities of the populace and the creativity of the authorities and citizens. The aim of a city is to support the health, the activities and the safety of its residents. It is, therefore, incumbent on city councils to protect the city by developing a master plan that balances heritage with conservation and development; fostering distinctive places with a strong sense of place, where densities are high enough to support basic public transit and walk-to retail services.

3.13 PRINCIPLE 13: URBAN GOVERNANCE, LEADERSHIP AND BEST PRACTICE

The city applying best practice for urban governance and sustainable procurement methods. Which networks and skills can be activated and utilized through engaging the local community and key stakeholders, to ensure sustainable outcomes?

Good urban governance is extremely important if we want to transform existing cities into sustainable compact communities. It has to provide efficient public transport, good public space and affordable housing, high standards of urban management, and without political support change will not happen. City councils need strong management and political support for their urban visions to be realized. They need strong support for a strategic direction in order to manage sustainability through coherent combined management and governance approaches, which include evolutionary and adaptive policies linked to a balanced process of review, and to public authorities overcoming their own unsustainable consumption practices and changing their methods of urban decision-making. A city that leads and designs holistically, that implements change harmoniously, and where decision-making and responsibility is shared with the empowered citizenry, is a city that is on the road to sustainable practices. In balancing community needs with development, public consultation exercises and grassroots participation are essential to ensuring people-sensitive urban design and to encouraging community participation. Citizens need to participate in community actions aimed at governments and big corporations, by writing letters and attending city-council hearings. Empowering and enabling people to be actively involved in shaping their community and urban environment is one of the

hallmarks of a democracy. Cities are a collective responsibility. As far as bureaucratic urban governance and best practice is concerned, authorities could consider many of the following: updating building code and regulations; creating a database of best practice and worldwide policies for eco-cities; revising contracts for construction projects and integrated public management; raising public awareness; improving planning participation and policy-making; creating sustainable subdivisions, implementing anti-sprawl land-use and growth boundary policies; legislating for controls in density and supporting high-quality densification; arriving at a political decision to adopt the *Principles of Green Urbanism*, based on an integrated *Action Plan*; measures to finance a low-to-no-carbon pathway; implementing environmental emergency management; introducing a program of incentives, subsidies and tax exemptions for sustainable projects that foster green jobs; eliminating fossil-fuel subsidies; developing mechanisms for incentives to accelerate renewable energy take-up; implementing integrated land-use planning; having a sustainability assessment and certification of urban development projects.

3.14 PRINCIPLE 14: EDUCATION, RESEARCH AND KNOWLEDGE

The city with education and training for all in sustainable urban development. How to best raise awareness and change behaviour?

The various aspects of this principle include: technical training and up-skilling, research, exchange of experiences, knowledge dissemination through research publications about ecological city theory and sustainable design. Primary and secondary teaching programs need to be developed for students in such subjects as waste recycling, water efficiency and sustainable behaviour. Changes in attitude and personal lifestyles will be necessary. The city is a hub of institutions, such as galleries and libraries and museums, where knowledge can be shared. We must provide sufficient access to educational opportunities and training for the citizenry, thus increasing their chances of finding green jobs. Universities can act as 'think tanks' for the transformation of their cities. We also need to redefine the education of architects, urban designers, planners and landscape architects. Research centres for sustainable urban development policies and best practice in eco-city planning could be founded, where assessment tools to measure environmental performance are developed and local building capacity is studied.

3.15 PRINCIPLE 15: STRATEGIES FOR CITIES IN DEVELOPING COUNTRIES

Particular sustainability strategies for cities in developing countries, harmonizing the impacts of rapid urbanization and globalization. What are the specific strategies and measurements we need to apply for basic low-cost solutions appropriate to cities in the developing world?

Developing and emerging countries have their own needs and require particular strategies, appropriate technology transfers and funding mechanisms. Cities in the developing world cannot have the same strategies and debates as cities in the developed world. Similarly, particular strategies for emerging economies and fast-growing cities are required, as is the problem of informal settlements and urban slums and slum upgrading programs. Low-cost building and mass housing typologies for rapid urbanization are required in cooperation with poverty reduction programs. It is essential that we train local people to empower communities, creating new jobs and diversifying job structures, so as not to focus on only one segment of the economy (e.g. tourism). Achieving more sustainable growth for Asian metropolitan cities is a necessity. Combating climate change, which was mainly caused through the emissions by industrialized nations and which is having its worst effect in poorer countries in Africa, Asia and Latin America, with a focus on Small Island States, is a priority.

It is important to note, that a couple of innovative engineering solutions will not deliver a vibrant city. All the technology in the world cannot achieve sustainability and vitality by itself.

The problem of urban design is far more complex. Designing a city requires holistic, multi-dimensional approaches, and each time the adaptation of strategies to a unique context: the integration and combination of qualitative and quantitative knowledge.

4. CONCLUSION

Much of *Green Urbanism* is common sense urbanism. In the future, *Green Urbanism* has to become the norm for all urban developments.

Increased material and energy consumption worldwide, coupled with an inadequate and unsustainable waste management system and a lack of resource recovery, has forced governments, industry and individuals to explore how to rapidly put into practice new measures to achieve responsible, closed loop solutions in waste management and resource recovery. Achieving sustainable materials flow in cities and 'zero waste' remains difficult and requires continued and combined efforts by industry, government bodies, university researchers and the people and organizations in our community.

The construction and demolition (C&D) sector has hereby a particular urgency to catch up with other sectors in better managing its material and waste stream, and increase the focus on reusing entire building components at the end of a building's life-cycle. Increasing the economic value of recycled commodities, such as rare metals in e-waste, metals, paper, glass and plastics remains an area for future development and investment.

This paper has touched on some of the urgent topics around sustainable urban development. It will be essential to continue to reduce wasteful consumption and to promote the cyclical reuse of materials in the economy by maximizing the value of our resources to make resource recovery the common practice. Our

objective must be to reconcile the scarcity of our natural resources with the almost 'infinite' quantities of waste produced by our cities and industries, which we must unfailingly recover.

The *15 Principles of Green Urbanism* are practical and holistic, offering an integrated framework, encompassing all the key aspects needed to establish sustainable development and encouraging best practice models. The replicability of models is hereby very important. The principles form a sustainability matrix, which will empower the urban designer – to borrow Richard Buckminster Fuller's words – to find ways of 'doing more with less.' (Buckminster Fuller, 1973)

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