



Eco-innovations in the urban regeneration projects



Planning and Management in eco-Cities

Stanisław Łobejko, Anna Stankowska, Mariusz Zabielski



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Contents

Publisher's note	6
Preface	8
Introduction	10
Chapter 1	
Foundation of eco-city – Stanisław Łobejko	13
1.1. Idea of eco-city	13
1.2. Typology of eco-cities	19
1.3. Determinants of eco-city development	24
1.4. Eco-city development strategies	26
1.5. Innovative eco-cities	30
1.6. Innovation initiatives in cities	34
Literature	37
Chapter 2	
Smart and Eco2 city ideas – Stanisław Łobejko	39
2.1. Idea of smart city	39
2.2. Smart cities in EU	42
2.3. Future smart city	44
2.4. Idea of Eco2 City	45
2.5. System approach	47
Literature	49
Chapter 3	
New Urbanism – concept and models – Stanisław Łobejko	51
3.1. Idea and main principles	51
3.2. Transit-oriented development	54
3.3. Compact City and Alternative City Models	55

3.4. Principles of Green Urbanism	63
3.5. Garden City movement	65
3.6. Carrot City	67
Literature	68

Chapter 4

The transformation of the city towards sustainability

- Stanisław Łobejko **70**

4.1. Space-economic approach and criteria	70
4.2. Urban land patterns	73
4.3. Planning sustainable city	75
4.4. Triple Bottom Line Model	78
4.5. The top-down strategy	80
Literature	83

Chapter 5

Planning in eco-city – Stanisław Łobejko **84**

5.1. Idea of city planning	84
5.2. Eco-city design principles	90
5.3. Types of city planning	92
5.4. Low-rise vs. high-rise	94
5.5. Planning process	95
5.6. Eco-city Design Charette	99
Literature	102

Chapter 6

Transportation planning and management – Mariusz Zabielski **104**

Introduction	104
6.1. The European Union’s legislation in transport	106
6.2. Ecological transport city	116
6.2.1. Passenger cars and lorries	126
6.2.2. Buses	131
6.2.3. Bicycles and walking	135
6.2.4. Ferries	138
Summary	139
Literature	139

Chapter 7

Energy efficiency – Planning and management in cities

- Anna Stankowska **142**

Preface	142
7.1. European policies and strategies about Energy Efficiency	144
7.1.1. Introduction	144
7.1.2. Documents related to buildings	145

7.1.3. Policy orientation to 2020 related to buildings	147
7.1.4. Main document about energy efficiency in buildings	151
7.1.5. Definition	156
7.1.6. Other documents about energy efficiency in buildings.....	157
7.2. Energy efficiency in Poland – building sectors	160
7.2.1. Introduction.....	160
7.2.2. Regulation and main documents about green building sectors.....	161
7.2.3. General information about energy efficiency	168
7.2.4. Planning and management at a local level. Plans for a low-carbon economy in municipalities	170
7.2.5. How to prepare guidelines for plans in cities	175
Literature	181

Chapter 8

Waste management – Anna Stankowska	183
Preface	183
8.1. Waste – general information about amount of waste in EU.....	184
8.2. Legal basis for waste – European policies and strategies.....	188
8.3. Definition of waste.....	195
8.4. General information about waste management planning.....	198
8.5. Waste planning and management at a regional or municipal level.....	199
Literature	206

Table of Contents	208
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Figure of Contents	209
---------------------------------	------------

Photo of Contents.....	211
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Publisher's note

We're delighted to bring you the book series prepared by the Authors taking part in the "[Eco-innovations in cities](#)" Project (POKL.04.03.00-00-249/12-00). The series, which is available free of charge, consists of six books:

- "[Eco-cities](#)" by Dominika Brodowicz, Przemysław Pospieszny and Zbigniew Grzymała
- "[Green Project Funding](#)" by Hanna Godlewska-Majkowska, Katarzyna Sobiech-Grabka, Paweł Nowakowski
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- "[Making the 21st Century Cities](#)" ed. by Krzysztof Jarosiński.

The Project was designed and prepared by Professor [Marek Bryx](#), Deputy Rector of the [Warsaw School of Economics](#) (SGH), and Doctor [Dominika Brodowicz](#). The Project has been carried out within the Priority IV "Tertiary Education and Science", Measure 4.3 "Strengthening the didactic potential of universities in the fields of key importance for the aims of Europe 2020 Strategy". In line with the objectives, the Project is conducted from 1st July 2013 until 31st December 2015.

The main aim of this Project was to create at the Warsaw School of Economics a one-year specialisation entitled "[Eco-innovations in the urban regeneration projects](#)". What is more, the Project's aim is to develop the study offer concerning the area of green and socially responsible eco-innovations in cities regeneration. The main objective of this new specialisation is to enhance students' knowledge

about eco-cities, give them sufficient information and discuss case studies on the subject: how contemporary cities should be planned, developed and managed. As most of our communities exist within the urban environment, the provision of eco-innovations is essential for the well-being of society. This unique educational programme for M.A. students provides information on maximising the benefits of making innovative and creative cities to citizens, local authorities, planners, developers, students, researchers and non-government organisations interested in improving the quality of life in cities.

MSc Alina Modrzejewska-Kořakowska – Project Manager
Prof. Anna Szelaęowska Ph.D. – Project Methodological Coordinator

Preface

We live in a time of dynamic development of information and communication technologies (ICT) increasingly determining the economic development of both the overall economy and in particular the development of cities. The fast development of technology makes changes in the materials and methods used in the construction industry, changes in means of transport, supply and social communication. Thanks to modern high advanced technology, people gain easier access to knowledge resources, become more aware of what is happening in their environment and become more involved in the affairs of local communities. Technology is not only changing the methods of urban development but also the lifestyle and living conditions of the inhabitants, allowing a steady increase in the quality of life. Based on ICT technologies cooperation changes the work and lifestyle of people. The development of the Web network makes it possible to acquire knowledge and to share it with others no matter of their location and place of residence. Knowledge was separated from traditional institutions like libraries and held by books and transferred to the network. "New technology is liberating learning and work from their traditional locations. The clean-cut boundaries of activities – the factory, the office, the university – are being replaced by networked, flexible connections to sources of information."¹ People interconnected via the network, share their knowledge with others, changing themselves from the ordinary workers in the ingenious professionals, which create new solutions, new knowledge and driving the new 'creative' economy. "Exchanges between art and technology – the exchange of ideas rather than commodities – are becoming the life-blood of the new economy and of our future prosperity. These changes directly affect the shape of the city because the information superhighway, cheap computer

¹ R. Rogers, *Cities for a small planet*, Westview Press, Boulder Colorado 1998, p. 162.

power and sophisticated manufacturing robotics revolutionize work practices.² Emerging innovations cause changes in the existing urban development. Nineteenth century industrial cities grew around rail nodes, which facilitated the supply of coal and steel needed for their development. Cities of the second half of the twentieth century were developed on the idea of zones of uniform functionalities. Cities of the 21st century will be developed based on the idea of creative activity on a small scale and will need to respond to the increasingly diversity of personal needs. This should have a great impact on behaviour of the contemporary city, and methods of planning cities as compact, ecological and sustainable eco-cities.

² [Ibidem.](#)

Introduction

Twenty-first century poses difficult questions, particularly in developing countries where rapid economic development will put pressure on cities to accommodate rising population. In these countries fast growing new megacities are expected. In response to climate change, environmental pollution, water shortage, and energy demand designers and policy makers will increasingly be involved in processes of implementing the idea of eco-city. This idea – today often considered as utopian – tomorrow can become reality. “Eco-city planning and management are based on the principle of a cyclical urban metabolism, minimizing the use of land, energy and materials, and impairment of the natural environment, ultimately leading to zero carbon settlements.”³ Most of eco-city plans are expensive and need long-term investments. Planning completely new eco-cities is very expensive and we can’t build all new cities from scratch. Most eco-city ideas assume that it is a great possibility to improve existing cities so that they can be eco-town, environment and inhabitant-friendly. We should consider whether in the current economic conditions rebuilding existing cities may be better than building new ones from scratch so as to meet the requirements of the eco-city idea. Such projects due to their smaller scale will require less effort and thus will become more realistic. Smaller scale of the eco-city projects will have shorter construction time and cost less and may lead to the realization of well-known ideas, such as a “carbon-neutral”, “zero-waste”, and “car-free” city. Designing a new city from scratch allows the use of comprehensive, whole systems approach, and more degrees of freedom than adaptation of an existing city.⁴ On the other hand, we should remember that, the resources and energy

³ *Eco-city planning policies, practice and design*, eds. T.-Ch. Wong, B.K.P. Yuen, Springer, Dordrecht 2011, p. v.

⁴ J. Fox, *Ecocities of Tomorrow: Can Foster + Partners’ Masdar City in the U.A.E. be Truly sustainable?*, “Treehugger”, March 4, 2008. Available on <http://www.treehugger.com/files/2008/03/masdar-roundtable.php>, accessed on 8 April 2014.

needed for new construction of a city will be far greater than redeveloping an existing city. Current trends suggest that the beliefs and movement toward eco-cities will spread worldwide and eco-city will be the main driving force for both the cities of today and tomorrow. And the cities of tomorrow will be sustainable and ecological ones. “An eco-city is an ecologically healthy city. No such a city presently exists. We do, however, see hints of eco-cities emerging in today’s solar, wind and recycling technologies, in green buildings and green businesses, in urban environmental restoration projects, urban gardening and organic farming, and in individuals using foot, bicycles and public modes of transportation in preference to the automobile. Car-free urban centres, “mixed use” and “balanced” development projects represent land use and architectural changes moving in the right direction, too.”⁵ The idea of an eco-city is very close to the idea of a sustainable city, which emphasizes compact land use, clean transport, and waste management, renewable energy (wind turbines and solar energy). But it has to be stressed as Stephen Lehmann claims that the technology aspects can’t dominate the eco-city idea. **“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.”**⁶ To accomplish such a noble eco-city idea we need a great involvement of local communities and authorities, academic institutions and organizations and their active participation in the planning and management of the city. Their implementation in practice will strongly depend on the knowledge and skills of people involved in planning and urban management processes, which would like to participate in processes leading to fulfilling the idea of the creation of completely new eco-cities or transforming the existing ones. City planning since its beginning at the end of 19th century has played a transformational role in improving the quality of life of all of our communities and has a critical responsibility for standard of living in the cities we have today. “It has the potential to enhance our wellbeing by giving people access to services, amenities and economic opportunities – and gives communities a say about their future.”⁷ But there is a strong need for understanding the importance how planners’ work affects living conditions of

⁵ *Eco-city Builders*, <http://www.ecocitybuilders.org/why-ecocities/the-problem-2/>, accessed on 8 April 2014.

⁶ S. Lehmann, *Green Urbanism: Formulating a Series of Holistic Principles*, S.A.P.I.E.N.S., Vol. 3, No. 2, <http://sapiens.revues.org/1057>, access 15.04.2014.

⁷ K. Henderson, *How town planning can help to eradicate the poverty*, “Guardian Professional”, 7 Nov. 2013, <http://www.theguardian.com/housing-network/2013/nov/07/planning-poverty-reduction>, access 10.05.2013.

the inhabitants of cities and clarity about the impact city planning has on communities. The new planning should be included within social policy and tailored for communities struggling with issues such as social exclusion.

It is important to remember that cities are different and this implicates that there is not one-size of an applicable eco-city model. It means how different cities are such different development strategies should be proposed. The strategies of sustainable eco-city development must be adjusted to the specificity and circumstances of the adopting countries. Different countries can adopt different approaches in implementing their own eco-city development strategy, relying on their financial and technological capabilities and criteria used and standards set for these cities would be adapted to the local circumstances.⁸

Literature

Eco-city Builders, <http://www.ecocitybuilders.org/why-ecocities/the-problem-2/>, accessed on 8 April 2014.

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Fox J., *Ecocities of Tomorrow: Can Foster + Partners' Masdar City in the U.A.E. be Truly sustainable?*, "Treehugger", March 4, 2008. Available on <http://www.treehugger.com/files/2008/03/masdar-roundtable.php>, accessed on 8 April 2014.

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Rogers R., *Cities for a small planet*, Westview Press, Boulder Colorado 1998.

⁸ *Eco-city planning policies, practice and design...*, op. cit., p. 8.

Chapter 1

Foundation of eco-city

Stanisław Łobejko

1.1. Idea of eco-city

Basically the idea of an eco-city means an ecological city. Why is this idea so important now and why do we dedicate so much attention to it? It is widely known that urbanization will be one of most urgent challenges of the 21st century. Right now more than half of the inhabitants of the earth live in cities, and it is expected that by the year 2050 this figure will increase up to 70%.⁹ This we know, but it is still the great unknown what the city of tomorrow will look and how smart living in these cities will be. In its current shape the cities are the source of many contaminants such as CO₂, smoke, noise, pollution, and a wide variety of organic and inorganic waste influencing dramatically climate change. They consume more and more energy in the way which is still very inefficient. New cities, cities of the future should become more energy and resource efficient, less polluting and more sustainable so as to provide residents with comfortable and healthy life and stable development of human civilization on Earth.

For more than 30 years we have been observing the rising global phenomenon of eco-cities, an urban innovation seen as one of the solutions which can help to solve problems of urban sustainability, environmental degradation, and climate change. The idea of an eco-city appeared as early as in the 1970s but remained

⁹ According to the estimate of the United Nations, 2007 is the year in which, for the first time in history, we have reached the point when more people live in cities than in the countryside. Department of Economic and Social affairs, Population Division, New York: United Nations, 2006, <http://www.un.org/esa/population/publications/WUP2005/2005wup.htm>, access 27.04.2014.

for many years only a theory and has not been implemented in practice. An eco-city originated in 1975 when Richard Register and few friends founded in Berkeley, California a non-profit organization named Urban Ecology, to help build new or transform old cities in balance with nature. The purpose of urban ecology was to build in Berkeley a “slow street” well equipped with trees along road, solar green houses, energy efficient and easy to use public transport and promoting pedestrianization as alternative to using an automobile. The term eco-city was popularized in the publication in 1987 of Register’s visionary new book *Ecocity Berkeley*.¹⁰ The popular Wikipedia defines a sustainable city, or an eco-city as a city designed with consideration of environmental impact inhabited by people dedicated to minimization of required inputs of energy, water and food, and waste output of heat, air pollution – CO₂, methane, and water pollution. The ultimate goal of many eco-cities is to eliminate all carbon waste, to produce energy entirely through renewable sources, and to incorporate the environment into the city; however, eco-cities also have the intentions of stimulating economic growth, reducing poverty, organizing cities to have higher population densities, and therefore higher efficiency, and improving health.¹¹ “Eco-city development integrates vision, citizen initiative, public administration, ecologically efficient industry, people’s needs and aspirations, harmonious culture, and landscapes where nature, agriculture and the built environment are functionally integrated in a healthy way.”¹² Another definition describes an eco-city as¹³:

- An ecologically healthy human settlement modelled on the self-sustaining resilient structure and function of natural ecosystems and living organisms.
- An entity that includes its inhabitants and their ecological impacts.
- A subsystem of the ecosystems of which it is part – of its watershed, bioregion, and ultimately, of the planet.
- A subsystem of the regional, national and world economic system.

In effect, eco-cities are ecologically healthy friendly to environment places where people can be more productive and happy with their life. They work to harmonize existing policies, regional realities, and economic and business markets with their natural resources and environmental assets. Eco-cities strive to engage all citizens in collaborative and transparent decision making, while being mindful of social equity concerns. Alluding to the Abu Dhabi World Future Energy Summit in January of 2010, Richard Register warns against misinterpretation of the eco-city terms limiting the term to design the whole

¹⁰ R. Register, *Ecocity Berkeley. Building Cities for the Healthy Future*, North Atlantic Books, Berkeley 1987.

¹¹ <http://en.wikipedia.org/wiki/Eco-cities>

¹² *Eco-city movement*, <http://ecocity.ncr.vt.edu/ecocitymovement.html>, access 14.04.2014.

¹³ <http://www.ecocitybuilders.org/why-ecocities/the-solution/ecocity-definition/>, access 15.04.2014.

city a little differently, using renewable energy systems, better recycling, rooftop gardens and shade roofs over building in hot climates, and more pedestrian-oriented streets. According to Register, the eco-city idea is based on the essence of the human being, not the car, powered by solar energy, fed by organic farming and designed to build soils and restore biodiversity and climate stability. Register suggests that rather than adapt cars to the requirements of an eco-city car manufacturers have started to think about changing their products line building streetcars, trains, elevators, bicycles and the mixed-use cities that bring jobs, commerce and social life close together on much smaller areas of land and additionally ensuring a full employment, planning and intelligence-rich strategy for green jobs.¹⁴ He calls the relationship between complex living organisms like our own bodies and the complex built environment of cities, towns and villages as “The Anatomy Analogy”, which allows to design a much more compact city with buildings linked by bridges and the full range of community life and economy organized in much smaller spaces, leaving much more land and water for nature and agriculture while demanding far less in resources for life in the city.¹⁵ The term eco-city suggests an ecological approach to urban design, management and a new way of lifestyle in harmony with the natural environment. “This implies that cities should be conceptualized as ecosystems where there is an inherent circularity of physical processes of resources, activities and residuals that must be managed effectively if the city’s environmental quality is to be maintained.”¹⁶

The term eco-city can be applied to an existing city or master plan of a new eco-city as indices Register when it explains that “there are two ways to go about building eco-cities: changing existing towns or building new ones”.¹⁷ The organization Urban Ecology¹⁸, founded in 1975, played an important role in promoting the idea of an eco-city. They defined their mission stating that “Urban Ecology uses urban design, land use planning, and policy reform to help communities plan and build neighbourhoods that are ecologically healthy, socially just, and economically fair.” Founded by visionary architects and activists who believed that cities should serve both people and nature Urban

¹⁴ *Originator of the Term “Eco-City” Cites Misuse*, <http://ecocity.wordpress.com/2009/11/05/originator-of-the-term-eco-city-cites-misuse>, access 14.04.2014.

¹⁵ These are the conclusions of Richard Register’s discussion with Arizona architect Paolo Soleri, in: *Originator of the Term “Eco-City” Cites Misuse*, <http://ecocity.wordpress.com/2009/11/05/originator-of-the-term-eco-city-cites-misuse>, access 14.04.2014.

¹⁶ *Eco-city planning policies, practice and design*, eds. T.-Ch. Wong, B.K.P. Yuen, Springer, Dordrecht 2011, p. 3.

¹⁷ R. Register, *Ecocity Berkeley...*, op. cit., p. 54. Richard Register founder of Urban Ecology in the San Francisco Bay Area, was one of the early advocates for linking ecological principles to the redesign of cities.

¹⁸ <http://www.urbanecology.org/mission.htm>

Ecology from the beginning, has used urban planning, ecology, and public participation to help design and build healthier cities. The mission of Urban Ecology is to create ecological cities based on the following 10 principles¹⁹:

1. Revise land-use priorities to create compact, diverse, green, safe, pleasant, and vital mixed-use communities near transit nodes and other transportation facilities.
2. Revise transportation priorities to favour foot, bicycle, cart, and transit over autos, and to emphasize “access by proximity.”
3. Restore damaged urban environments, especially creeks, shore lines, ridgelines, and wetlands.
4. Create decent, affordable, safe, convenient, and racially and economically mixed housing.
5. Nurture social justice and create improved opportunities for women, people of colour, and the disabled.
6. Support local agriculture, urban greening projects, and community gardening.
7. Promote recycling, innovative appropriate technology, and resource conservation while reducing pollution and hazardous wastes.
8. Work with businesses to support ecologically sound economic activity while discouraging pollution, waste, and the use and production of hazardous materials.
9. Promote voluntary simplicity and discourage excessive consumption of material goods.
10. Increase awareness of the local environment and bioregion through activist and educational projects that increase public awareness of ecological sustainability issues.

Chattanooga and the San Francisco Bay Area in the U.S., Ottawa, Hamilton-Wentworth, and Greater Toronto in Canada, and Curitiba in Brazil are among first cities which have applied an eco-city planning concept on a small scale with success. On the big scale the idea of an eco-city has become real in the last decade which is confirmed by implementation of such projects as for example the construction of model eco-cities, such as Dongtan, near Shanghai, China, and Masdar, near Abu Dhabi, UAE. Many other eco-cities initiatives are now underway or about to be launched worldwide. The initiative taken by Westminster University (UK), the Johns Hopkins University and Lemelson Centre, which is a co-sponsor of the International Eco-City Initiative, has also

¹⁹ *Blueprint for Sustainable Bay Area. Envisioning the Monterey Bay Area*, Association of Monterey Bay Area Governments, 2011.

the same nature. Research conducted by these institutions shows a sharp increase in the number of initiatives to more than 200 worldwide. Despite the dynamic growth in the number of initiatives, eco-cities are still an ongoing discussion on the definition of an eco-city and defining it is still a difficult challenge, for both theoretical and practical reasons. In general, the idea of an eco-city is perceived as a city which is more sustainable than today's existing cities. But there are no agreed standards and norms of what is meant by an eco-city concept. In practice, there are so many different environmental, social and technological situations that in each of them it may mean something else and that is why eco-cities initiatives end up taking diverse forms and shapes. The ideal "eco-city" has been described as a city that fulfils the following requirements^{20, 21}:

- Operates on a self-contained economy, resources needed are found locally
- Has completely carbon-neutral and renewable energy production
- Has a well-planned city layout and public transportation system that makes the priority methods of transportation as follows possible: walking first, then cycling, and then public transportation.
- Resource conservation – maximizing efficiency of water and energy resources, constructing a waste management system that can recycle waste and reuse it, creating a zero-waste system
- Restores environmentally damaged urban areas
- Ensures decent and affordable housing for all socio-economic and ethnic groups and improve jobs opportunities for disadvantaged groups, such as women, minorities, and the disabled
- Supports local agriculture and produce
- Promotes voluntary simplicity in lifestyle choices, decreasing material consumption, and increasing awareness of environmental and sustainability issues.

The eco-city design should satisfy above conditions and must be able to grow and evolve as the population grows and the needs of the population change. Each eco-city project has its individual character and also sets its own requirements to ensure that the city will be environmentally sustainable. All eco-cities should be regarded as organisms, and analysed as such, in an attempt to improve their current environmental performance and long-term sustainability.²² During a graduate seminar at Yale conducted by G. Geballe and

²⁰ M. Roseland, *Dimensions of the Eco-city*. "Cities" 14 (4) 1997, p. 197-202.

²¹ F. Harvey, *Green vision: the search for the ideal eco-city*, "Financial Times", Retrieved 21 November 2011.

²² T.E. Graedel, *Industrial Ecology and the Ecocity*, "The Bridge, Urbanization & Engineering", Vol. 29. No. 4, Winter 1999.

T.E. Graedel, entitled "Designing the Ecocity", the following principles were elaborated as help to define an eco-city²³:

- The city must be sustainable over the long term.
- The city must utilize a systems approach to evaluate its environmental interactions.
- The city design must be flexible enough to evolve gracefully as the city grows and changes.
- The open space of an eco-city must serve multiple functions.
- The city must be a part of regional and global economies.
- The city must be attractive and workable.

The eco-city initiatives have to be analysed in relation to the conditions and level of development of the country in which they are implemented. It should expect large differences in the meaning and implementation in practice the idea of an eco-city in a variety of environmental conditions. But regardless of the circumstances, these initiatives have much in common and the most important of them is Eco-cities innovation and policy of "*ecological modernization*", which aims to decouple economic growth from environmental degradation. As an example of such an approach can be World Bank's Eco2 Cities initiative²⁴ described by the slogan "*environmental city as economic city.*" This approach is accompanied by increasing international knowledge transfer, with international architecture, technology, and engineering firms playing a central role. The term eco-city covers various notions of, and approaches to, sustainable urbanism and it brings together multiple forms of sustainable development. Parallel to the concept of an eco-city are such concepts as: climate-neutral city, low-carbon city, zero-carbon, carbon-neutral, sustainable city, transition towns, smart city and many others. Sometimes co-cities are defined as zero-carbon, sustainable, bionic, network or digital.²⁵ Visionaries are trying to create the idea of new cities called Invincible Cities, built on a completely new, highly technologically advanced materials of the future. "Invincible Cities in our term for the future: the city as an open-ended organism of the Materiomic Age²⁶ rather than sealed machine of the Industrial Age. These cities are invincible because they make a difference even before commonly cited parameters of the urban success story – economic growth, housing supply, incidences of poverty and crime, traffic congestion communication

²³ Ibidem, p. 12.

²⁴ *Ecological Cities as Economic Cities*, www.worldbank.org/eco2, access 10.04.2014.

²⁵ *Cities for Smart Environmental and Energy Futures. Impacts on Architecture and Technology*, eds. S.Th. Rasia, P.M. Pardalos, Springer-Verlag Berlin Heidelberg 2014, p. v.

²⁶ Age of new materials such as nanomaterials, biomaterials etc.

network, quality of schools and cultural amenities, and so on – are taken into account.”²⁷ An important prerequisite for the realization of the idea of eco-cities is the construction of the digital city infrastructure providing cohesive and widely open telecommunication and software architecture empowering the smart citizen-centric applications. “The building blocks upon which smart cities will be created include smart and renewable energy; next generation networks, smart buildings, smart transport; and, extremely important, smart government.”²⁸

1.2. Typology of eco-cities

In the literature one can find many different typologies of eco-cities. Some of them are completely new and present a new approach to this phenomenon, the others go back to the traditional theory of city planning and management. Here will be presented typologies related to eco-city planning.

In the research conducted in 2009 and 2011 there are identified various types of eco-cities according to three types of variables²⁹: type of eco-city-development, development phase and key implementation mode.

Table 1.1. Eco-cities by type of development, development phase and key implementation mode

Variable	Type of eco-city development
Range	I. new development
	II. expansion of urban area
	III. retro-fit development
Variable	Development phase
Range	1. pilot/planning stage
	2. under construction
	3. implemented
Variable	Key implementation mode
Range	a. technological innovation
	b. integrated sustainability vision/planning
	c. civic empowerment/involvement

Source: S. Joss, D. Tomozeiu, R. Cowley, *Eco-Cities – A Global Survey 2011. Eco City Profiles*, University of Westminster International Eco-Cities Initiative, September 2011, p. 2, www.westminster.ac.uk/ecocities

²⁷ *Cities for Smart Environmental and Energy Future...*, op. cit., p. 66.

²⁸ *Ibidem*, p. 9.

²⁹ S. Joss, D. Tomozeiu, R. Cowley, *Eco-Cities – A Global Survey 2011. Eco City Profiles*, University of Westminster International Eco-Cities Initiative, September 2011, p. 2, www.westminster.ac.uk/ecocities.

By definition an eco-city should meet the assumption of sustainable development. In the paper titled “*Sustainable Urban Forms. Their Typologies, Models, and Concepts*” Y.R. Jabareen identifies and analyses sustainable urban forms and their design concepts. In the performed analysis he identifies seven design concepts related to sustainable urban forms³⁰:

1. compactness,
2. sustainable transport,
3. density,
4. mixed land uses,
5. diversity,
6. passive solar design, and
7. greening.

The compactness is a widely used strategy for urban development, assuming limiting the sprawling of the contemporary cities and bringing to them a number of benefits such as minimizing transport of energy, water, materials, product and people. Implementation of the strategy is carried out by more efficient land use and increasing the density of development and activity. This can be done by building previously undeveloped areas, redevelopment existing buildings as also development of subdivisions and conversions. According to Y. R. Jabareen the scientific debate is dominated by four major topics. The first one highlights the possibility of rural protection. The second theme concerns the increasing quality of life achieved by intensification of social interconnections and easy access to the city services and facilities. The third theme of discussion is concentrated on a steady reduction of energy consumption. The compactness of the city helps to reduce the costs of delivery for different types of energy: heating, electricity, etc. And finally, the fourth topic of discussion relates to reduction of greenhouse gas emission by reducing the number and length of city trips and using environmentally friendly private and public transport.³¹

The second concept influencing sustainable urban forms is the sustainable transport, which significantly affects the mobility and the traffic through the city, depending on the level of city transport technologies development. Sustainable urban form should include appropriate forms for walking, cycling and using of public transport with minimizing the environmental costs. Many authors define sustainable transport as responding to full social needs and simultaneously respecting its social and environmental costs and carrying

³⁰ Y.R. Jabareen, *Sustainable Urban Forms. Their Typologies, Models, and Concepts*, “Journal of Planning Education and Research”, September 2006, vol. 26 no. 1, p. 38-52.

³¹ *Ibidem*, p. 40.

capacity. The others indicate that the sustainable urban transportation system should limit emissions and waste; use renewable energy sources; minimize use of the land; provide easy access for people and their goods creating good conditions for life. The system should be also financially efficient and giving strong support for economic development. The land planning plays a key role in achieving such sustainable city goals as reducing needs for city movement and provide adequate to the needs but also energy-efficient and environmentally friendly forms of transport. New forms of city transport planning can help radically save the energy. "The influential literature of neotraditional planning and "new urbanism" often argue that car use will decline in neighbourhoods designed with more pedestrians-friendly features, such as connected street layouts, more mixed use, high enough densities, to more closely group some commercial and residential development, traffic calming and so on."³² The third design concept – density – is heavily connected with sustainable transportation system. The density is measured as ratio of people or dwelling units to land area. Density and dwelling type can differ in the respect of consumption of energy; materials; and land for housing, transportation, and urban infrastructure. Some policies can save significant amounts of energy, mainly by "increasing the urban density; strengthening the city centre; extending the proportion of a city that has inner-area land use; providing a good transit option; and restraining the provision of automobile infrastructure."³³ Density is the single most important factor influencing transport use. Increasing density affects decline in automobile using and travel, measured by gasoline consumption or per capita vehicle miles of travel (VMT). At the same time the transit increase is observed. As stated Transportation Research Board of the National Academy in 1996 holding constant the mix of land uses, residents of higher density areas were more likely to commute by transit, walking, bicycling, or combinations thereof, and less likely to drive than people who live in lower-density areas.³⁴ On the other hand, they are researchers arguing that sustainable development implies a "self-support economy" and requires "more land for outbuildings and outdoor activities . . . and a general reduction in net residential densities."³⁵ It seems that in the future, it can coexist in both places with a high population density as well as those of lower density. You can imagine that in cities, as centres of economic,

³² Ibidem, p. 40.

³³ P. Newman, J. Kenworthy, *Gasoline consumption and cities: A comparison of US cities with a global survey*, "Journal of the American Planning Association" (55)1989, p. 23-37.

³⁴ Transportation Research Board of the National Academy, *Transit and urban form*. Report 16, vol. 2. Washington, DC: National Academy Press 1996.

³⁵ C.M.P. Burall, P. Roberts, *A sustainable economy, in: Planning for a sustainable environment*, ed. Andrew Blowers, Earthscan, London 1993.