Eco-innovations in the urban regeneration projects

Planning and Management in Eco-cities

Stanisław Łobejko, Anna Stankowska, Mariusz Zabielski

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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:

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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-Kołakowska – Project Manager
Prof. Anna Szelągowska 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

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

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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 CO_2, 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 – CO_2, 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 as[13]:

- 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 Ecology[18], 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

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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 principles[19]:

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-city[23]:

- 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 initiative[24] 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 Age[26] 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. Rassia, 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-cites 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 variables[29]: 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 forms[30]:

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 cites 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 efficiently 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,

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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.

cultural and social development, built to the new patterns of an eco-city, people at the working and retirement age as well as the ones seeking peace and quiet, authors and also creators will live and coexist together.

There is a full consensus among planners and scholars that mixed land use plays an important role in achieving a sustainable eco-city. For the past several decades in urban planning has dominated homogeneity idea based on the rigid zoning that separates different parts of the city plan, as commercial, industrial, institutional and residential independent districts. In effect, less diversity in local areas generates more traffic, car using, a higher cost of infrastructure and many others. Mixed land use reduce the need for travel and car using for commuting, shopping, leisure since jobs, shops, and leisure facilities are located nearby and can be reached easily by cycling or walking. In eco-city planning mixes the use of land should be encouraged whereas zoning of city discouraged. "Reducing the need for travel is on the agenda of achieving sustainable urban form, and mixed land use has a prominent role in achieving it."[36]

There are many similarities between diversity and mixed land uses. According to the Congress for the New Urbanism and U.S. Department of Housing and Urban Development held in 2000 there is a strong need for stopping sprawl and re-establishing compact, walkable, and environmentally sustainable neighbourhoods, cities, and towns.[37] Diverse development has an multidimensional character because contains a mixture of land uses, building and housing types and architectural styles as well as different urban forms in respect to the social and cultural context. "If development is not diverse, then homogeneity of built forms often produces unattractive, monotonous urban landscapes, a lack of housing for all income groups, class and racial segregation, and job-housing imbalances that lead to increased driving, congestion, and air pollution".[38]

For the eco-city planning reducing the demand for energy and providing the best use of passive energy in sustainable ways are also very important. Passive solar design plays a crucial role for the sustainable environment of the city, in respect for example of the buildings orientation and urban density. It is assumed that design, orientation, layout, and landscaping can optimize using of solar devices regarding the microclimatic conditions to minimize the need for space

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36 Y.R. Jabareen, *Sustainable Urban Forms. Their Typologies, Models, and Concepts*, "Journal of Planning Education and Research", September 2006, vol. 26 no. 1, p. 41.

37 http://www.cnu.org/sites/files/CNU_2262_HUD_8=11.pdf, access 15.04.2014.

38 S.M. Wheeler, *Planning for metropolitan sustainability*, "Journal of Planning Education and Research" 20, 2000, p. 328.

heating or cooling of buildings by conventional energy sources.[39] On the built urban area there is more potential for gathering the solar radiation thanks to the city flat and open terrains. But this depends on city surface exposures which is largely determined by the architectural forms, as well as the street widths and orientation. They are some design parameters which can help to improve urban microclimate and achieve environmentally sustainable cities[40]:

1. *built form* – density and type, to influence airflow, view of sun and sky, and exposed surface area;
2. *street canyon* – width-to-height ratio and orientation, to influence warming and cooling processes, thermal and visual comfort conditions, and pollution dispersal;
3. *building design* – to influence building heat gains and losses, albedo and thermal capacity of external surfaces, and use of transitional spaces;
4. *urban materials and surfaces finish* – to influence absorption, heat storage, and emissivity;
5. *vegetation and bodies of water* – to influence evaporative cooling processes on building surfaces and/or in open spaces; and
6. *traffic* – reduction, diversion, and rerouting to reduce air and noise pollution and heat discharge.

In the eco-city planning design concept, named greening of the city, or *green urbanism,* plays a very important role. This concept is based on previously urban design movement called New Urbanism, which arose in the USA in the early 1980s. New Urbanism promotes 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. Greening of the city brings many benefits for living: it makes urban and suburban places appealing and pleasant, and more sustainable. Additionally, the greening of the city can help protect the environment by reducing pollution, moderating the extremes of the urban climate, and contributing to cost-effective sustainable urban drainage systems, increasing the economic attractiveness of a city and improving health of their inhabitants, preserve and enhance the ecological diversity of the environment of urban places, and many others.[41]

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39 S. Owens, *Energy, environmental sustainability and land-use planning*, in: *Sustainable development and urban form*, ed. Michael Breheny, Pion, London 1992.

40 S. Yannas, *Living with the city: Urban design and environmental sustainability*, in: *Environmentally friendly cities*, eds. Maldonado Eduardo and Simon Yannas, James & James, London 1998, p. 43.

41 Y.R. Jabareen, *Sustainable Urban Forms. Their Typologies, Models, and Concepts*, "Journal of Planning Education and Research", September 2006, vol. 26 no. 1, p. 43.

1.3. Determinants of eco-city development

The term eco-city is a very complex, and multi-dimensional concept. Therefore, eco-city development is dependent on a wide variety determinants. Among them we can name at least those associated with city compactness reducing the need for traveling, mixed-use land and urban form, human-oriented city centres, modern public transport system reducing air pollution and protecting city's natural environment. These and many other factors influence strongly further eco-city development and indicate the main determinants of an eco-city development. The eco-city development will depend largely on the determination of citizens and their government and willingness to act, technological development, economic growth, and innovation. They should comply with the requirements to be met by an eco-city[42]:

1. *Ecological security* – clean air, and safe, reliable water supplies, food, healthy housing and workplaces, municipal services and protection against disasters for all people.
2. *Ecological sanitation* – efficient, cost-effective eco-engineering for treating and recycling human excreta, grey water, and all wastes.
3. *Ecological industrial metabolism* – resource conservation and environmental protection through industrial transition, emphasizing materials re-use, life-cycle production, renewable energy, efficient transportation, and meeting human needs.
4. *Ecoscape (ecological-landscape) integrity* – arrange built structures, open spaces such as parks and plazas, connectors such as streets and bridges, and natural features such as waterways and ridgelines, to maximize biodiversity and maximize accessibility of the city for all citizens while conserving energy and resources and alleviating such problems as automobile accidents, air pollution, hydrological deterioration, heat island effects and global warming.
5. *Ecological awareness* – help people understand their place in nature, cultural identity, responsibility for the environment, and help them change their consumption behaviour and enhance their ability to contribute to maintaining high quality urban ecosystems.

Knowledge about the determinants of the eco-city development is important but even more important is the knowledge about the actions to be taken in

[42] *The San Francisco Eco-city Declaration*, Ecocity World Summit 2008, http://ecocity.wordpress.com/2008/05/15/san-francisco-ecocity-declaration/, access 14.04.2014.

order to begin and sustain eco-city development. Among many actions which are necessary for the eco-city development the following can be mentioned[43]:

1. Provide safe shelter, water, sanitation, security of tenure and food security for all citizens and with priority to the urban and rural poor in an ecologically sound manner to improve the quality of lives and human health.
2. Build cities for people, not cars. Roll back sprawl development. Minimize the loss of rural land by all effective measures, including regional urban and peri-urban ecological planning.
3. With "eco-city mapping" identify ecologically sensitive areas, define the carrying capacity of regional life-support systems, and identify areas where nature, agriculture and the built environment should be restored. Also identify those areas where more dense and diverse development should be focused in centres of social and economic vitality.
4. Design cities for energy conservation, renewable energy uses and the reduction, re-use and recycling of materials.
5. Build cities for safe pedestrian and non-motorized transport use with efficient, convenient and low-cost public transportation. End automobile subsidies, increase taxation on vehicle fuels and cars and spend the revenue on eco-city projects and public transportation.
6. Provide strong economic incentives to businesses for eco-city building and rebuilding. Tax activities that work against ecologically healthy development, including those that produce greenhouse gases and other emissions. Develop and enhance government policies that encourage investment in eco-city building.
7. Provide adequate, accessible education and training programs, capacity building and local skills development to increase community participation and awareness of eco city design and management and of the restoration of the natural environment. Support community initiatives in eco-city building.
8. Create a government agency at each level – village, city, regional, national and international – to craft and execute policy to build the eco-city and promote associated ecological development. The agency will coordinate and monitor functions such as transportation, energy, water and land use in holistic planning and management, and facilitate projects and plans.
9. In policy at all levels of government and in the decision making bodies of all institutions – universities, businesses, non-governmental organization,

[43] *The San Francisco Eco-city Declaration*, Ecocity World Summit 2008, http://ecocity.wordpress.com/2008/05/15/san-francisco-ecocity-declaration/, access 14.04.2014.

professional associations and so on – address in the plans and actions of those institutions specifically what can be done through the institutions' physical design and layout relative to its local community to address global heating, the coming end of fossil fuels and global crisis of species extinctions.

10. Encourage and initiate international, inter-city and community-to-community cooperation to share experiences, lessons and resources in eco-city development and promote eco-city practice in developing and developed countries.

1.4. Eco-city development strategies

Today's world becomes increasingly urbanized. In this new urbanized world cities will provide the most important driving force of economic and civilization development and their role as an engine of economic growth has become more and more important. Therefore, for contemporary cities strategic planning and strategy development are very important because they decide about their future prosperity or collapse. The strategy can help a city harness the potential of urbanization and make the most of opportunities, giving residents also a chance to have a voice in the future of the place where they live. City development strategy is a result of strategic planning process, which can be defined as systematically and formally documented process for formulation of goals and deciding what is the main set of key decisions that a city will have to undertake in the next few years in order to achieve their long-term goals. The strategic planning process should result in direct city development strategic plan.

The City Alliance – a global partnership for urban poverty reduction and the promotion of the role of cities in sustainable development – cities in preparing city development strategies that link their economic growth and poverty reduction objectives, often including citywide slum upgrading strategies.[44] They proposed definition of City Development Strategy (CDC) as: "A city development strategy is an action-oriented process, developed and sustained through participation, to promote equitable growth in cities and their surrounding regions to improve the quality of life for all citizens."[45] A city development strategy is an approach oriented on long-term perspective in urban planning, which can help cities move beyond short-term planning to considering where

[44] http://www.citiesalliance.org/node/3750, access 20.04.2014.

[45] http://www.citiesalliance.org/about-cds, access 20.04.2014.

the city should be in 20 or 30 years, and what steps that need to be taken to achieve those goals.

In the last years local and national governments and regional bodies such as the European Union have emphasised the need for a holistic understanding of urban planning and have taken activities focused on establishing an international policy in urban planning. Right now, in the area of urban planning, the responsibility of local governments are limited to land use and infrastructure provision excluding inclusive urban development strategies. The advantages of city strategic planning include an increase in governance and cooperation that aides local governments in establishing performance based-management, focused on long-term city development. One has to agree with the view that city strategic planning is the challenge facing local community and relates rather to local than national level government. The local government in frame of local decision processes is responsible for the city strategic planning. Strategic planning facilitates cooperation between stakeholders and helps preserve continuity between plans and the change in local government. It can also act as a platform for cooperation and development of new concepts and models of housing, energy and mobility. Additionally, a city development strategy has several different advantages[46]:

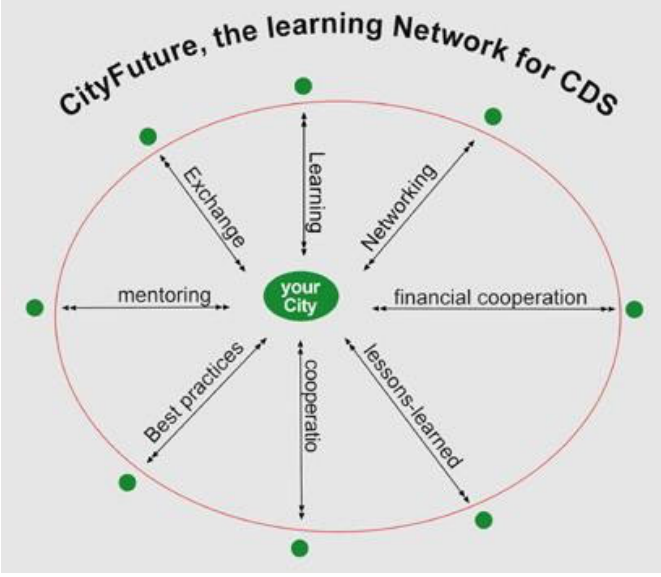
- It encourages stakeholders to invest and behave according to a vision, effectively pulling in one direction – getting priorities right is crucial to success;
- It cost-effectively allocates resources to a few key strategic areas;
- It helps a city anticipate future shocks and rapidly changing contexts (the risk environment) and raises its understanding of how stakeholders would respond under various scenarios;
- It enables a city to anticipate the rate, type, and physical direction of growth and to develop infrastructure ahead of growth.

Despite growing awareness of the need to change the current approach to urban development planning does not yet exist a coherent policy defining strategies for the development of sustainable, modern cities of the future modern eco-city which could be called an eco-city. There still are not established international standards for eco-city development. Different countries and organizations take actions in this field but they are uncoordinated and follow to some not very well-defined goal and therefore they are more actions of seeking

[46] *Guide to City Development Strategies. Improving Urban Performance*, The City Alliance, Washington 2006, p. 24, https://www.citiesalliance.org/sites/citiesalliance.org/files/CA_Docs/resources/cds/cds-guidelines/cds_guidelines_final.pdf, access 20.04.2014.

solutions to current problems that plague the contemporary city than a strategy focused on the implementation of a particular vision of the future of the city. Efforts to change this situation are made by an organization, the United Cities and Local Governments (UCLG) http://www.uclg.org/ that is working to establish universal urban strategic guidelines. The UCLG is a democratic and decentralized structure that operates in Africa, Asia, Eurasia, Europe, Latin America, North America, Middle East, West Asian and a Metropolitan section. The organization has 60 members working together to promote a more sustainable society, evaluate urban development strategies and debate these experiences to make the best recommendations.

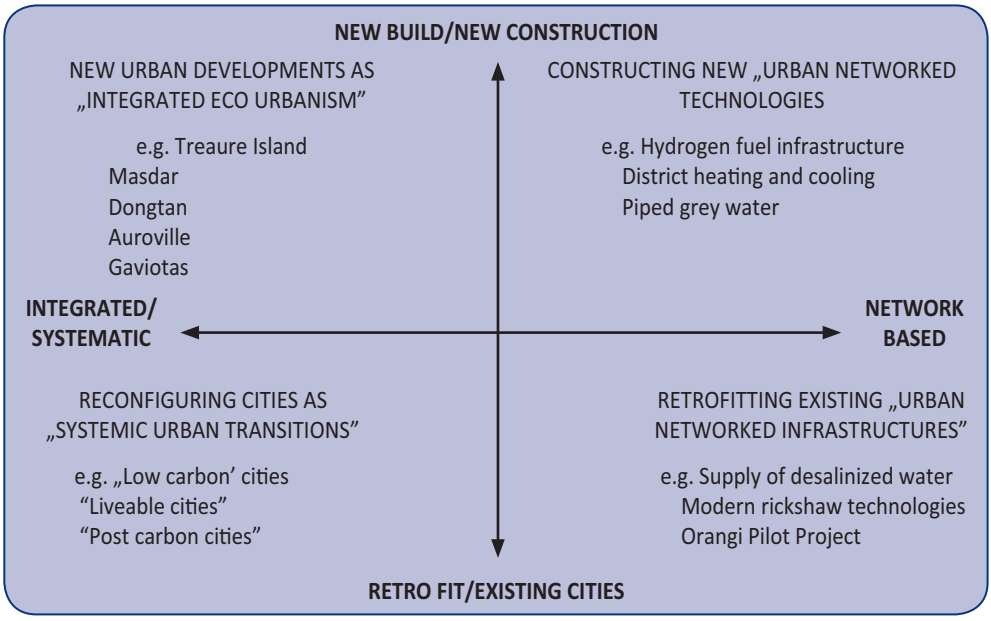
Figure 1.1. Most important factors influencing City Development Strategies (CDS)



Source: http://www.uclg.org/en/issues/urban-strategic-planning, access 20.04.2014.

A lot of efforts in devising the strategy of eco-city development is undertaken by experts and enthusiasts of the eco-city idea. An interesting example of attempts to systematize the existing directions and strategies for the development of an eco-city is shown in the following diagram.

Figure 1.2. Diagram showing the main directions and strategies for the development of eco-city



Source*: What Does the Green Economy Mean for Sustainable Urban Development?* Expert Group Meeting, Tribe Hotel, Nairobi, 17-18 February 2011, p. 9.

Eco-cities initiatives will play a crucial role in the creation of green economies that are pro-environment, pro-growth and pro-jobs. It will be possible to achieve through by improvement of economic competitiveness, being strategic in spatial planning and planning around landscape ecologies. We observe a still growing carbon emissions trend alongside urban populations, but some countries like Germany and Sweden have been able to reverse it. New, serious thinking about climate change and emissions allows to see the costs of renewable energy technologies decreasing, while resource-intensive conventional energy technologies are still increasing. It indicates seven operational strategies that can help cities make a transition toward a green economy, and have proven to be successful in examples from around the world[47]:

- Embrace land mosaic patterns that provide for large green patches and more sustainable urban development (e.g. Berlin and Medellin)
- Promote compact cities and planned extension of urban areas (e.g. Stockholm's Hammarby Sjoestad urban redevelopment project)

[47] *What Does the Green Economy Mean for Sustainable Urban Development?* Expert Group Meeting, Tribe Hotel, Nairobi, 17-18 February 2011, p. 9-10.

- Balance strategic facilities with diversified local economic opportunities (e.g. Holland's Randstad Region where cities are somewhat specialized, but all still provide basic services)
- Expand network infrastructure while getting the most out of existing networks (e.g. Bogota's bus rapid transit system, and the addition of geothermal and wind energy to Kenya's energy mix)
- Construct greener built environments that use water and energy efficiently (e.g. Cape Town's use of Clean Development Mechanism (CDM) funds to retrofit solar water heaters onto low cost houses)
- Protect valuable ecosystem services and biodiversity hotspots while increasing resilience to some natural disasters (e.g. Berlin's Tiergarten Park that acts as a green lung for the city, or the mangrove swamps near Ho Chi Minh city that protect it from typhoons)
- Promote clusters of green industries and green jobs (e.g. California's East Bay Green Corridor Partnership, or Gauteng's Strategy for a Developmental Green Economy).

1.5. Innovative eco-cities

Since the beginning of the 21st century we can still see the growing importance of cities as centres of scientific, technological and social development. But what distinguishes contemporary urban development from the city development earlier eras is the fact that it is based on innovation, and now the cities are accelerators of progress and innovation. "While the planning and design community remains justifiably fixated on advancing sustainability, the world of business and economic development has shifted its focus to the emergent innovation economy. To make the most of the rapidly unfolding new era, urban design and development professionals must respond with long overdue innovations in how we plan, design, develop, regulate, and think about cities that address not only ecological sustainability, but also the new imperatives of economic prosperity."[48] Technological changes emerge computer-driven telecommunication which facilitate the development of unprecedented connectivity across the world of highly motivated people and companies to work, collaborate, and compete in the global marketplace. In this new environment they caused fundamental changes in the mode of production and

[48] M. Freedman, E. Calloway, G. Tung, *Next City: City Design and Urban Planning Innovation for the New Era*, Smart Growth Network: National Conversation on the Future of Our Communities, http://www.smartgrowth.org/nationalconversation/compendium/18_Freedman_Calloway_Tung_Next_City_020713.pdf, access 25.05.2014, p. 100.

distribution as well as in life and work of the people. Contemporary firms focused on knowledge intensive products need highly skilled workers to invent new and improve existing products and services with increased speed and creativity.[49] They need more, high technologically advanced products and services to compete on global market. To win this strong competitive battle on contemporary market the companies need to be more and more innovative and they have understood that a great majority of innovations have resulted from group collaboration rather than individual effort.[50] All this resulted in growing need to change the urban environment and making the city a place which is friendlier not only for living but also for work. Still an increasing number of knowledge workers, which – thanks to the digitalization processes – work in their homes instead of going every day to workplace. "New organizational formats and office designs such as co-work, work cafes and incubators have also emerged to fit the creative focus of the growing legion of start-ups and small businesses that make up the fastest growing segment of the innovation economy."[51] This changes growing demand for dense, mixed-use, pedestrian-friendly district, convenient transportation, high quality services, and comfortable housing suitable for knowledge workers and companies. Just as happened in the past, changes in production methods forcing changes in lifestyle, working conditions in conjunction with the city as a place of residence. Most of the cities were planned in the era of industrial production and lifestyle and now are not relevant to the new economic and social conditions of innovation economy. Therefore, we are now facing a great challenge rebuilding our cities to suit the requirements and needs of the contemporary, educated people working creatively on new products and services. "This is a time of enormous opportunity. But to secure the full benefits of the rapidly unfolding new economy, we must realign our city-building ideas, practices, and institutions with the new drivers of prosperity."[52] For this we need a new perspective on urban planning methods, taking into account the needs of contemporary inhabitants and enable sustainable development of the city. We need to engage all city communities to work together with planners, city authorities, companies and institutions in order to search new and innovative solutions in the city design and development, which will lead to a new type of city called an eco-city.

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49 L.A. Karoly, C.W.A. Panis, T*he 21st Century at Work: Forces Shaping the Future Workforce and Workplace in the United States*, The RAND Corporation, Santa Monica 2004.

50 S. Johnson, *Where Do Good Ideas Come From: The Natural History of Innovation*, Riverhead Books, New York 2010.

51 M. Freedman, E. Calloway, G. Tung, *Next City: City Design and Urban Planning Innovation for the New Era*, Smart Growth Network: National Conversation on the Future of Our Communities, http://www.smartgrowth.org/nationalconversation/compendium/18_Freedman_Calloway_Tung_Next_City_020713.pdf, access 25.05.2014, p. 101.

52 Ibidem, p. 102.

The previous history of the development of cities shows that the city has always been a place where new ideas were born and their inhabitants were characterized by creativity and a willingness to make changes. Living and working in the cities in which people live and work very closely causes that opportunities and ideas in city community seem to grow at a high rate. This role applies to cities in all eras of history of urban development.

From economic point of view Adam Smith saw as reasons for the increase creativity and innovation of people living in cities the division of labour.[53] Other economists try to explain the fact through high concentration on a small land area of people, companies and institutions remaining in mutual interactions with each other.

Contemporary surveys carried out by researchers at the Santa Fe Institute have proven the maths behind the power of cities: "As they grow in population, all kinds of positive outcomes like patents and GDP and innovation (and negative ones like STDs and crime) grow at an exponential factor of 1,1 to 1,3."[54] This means that growth of the benefits (and downsides) related to city size is not linear but exponential. Thus, the researchers conclude that super-linear growth rate is directly tied to how growing density of cities enables us to connect to each other. Those connections (networks) are the main factors increasing productivity, creativity and innovation. As MIT researcher Wei Pan says, "What really happens when you move to a big city is the fact that you get to know a lot of different people, although they are not necessarily your 'friends' but these are the people who bring different ideas, bring different opportunities, and meetings with other great people that may help you."[55] From here you can draw a direct conclusion that city's infrastructure plays a very important role, which can facilitate (or impede) may facilitate (or hinder) establishing and maintaining contacts in the city. This is a fact which should be necessarily taken into consideration in the city planning process.

To meet this challenge you should try to understand the nature and operation of the network entities. Networking indicators measuring strategic partnerships, licensing, intellectual property, informal cooperation and exchange of knowledge in the form of business, personal relationships between organizations (e.g. clusters) may be helpful in this regard. There should also be adequate strategies of innovation networks based on the formation of network economic structures enabling the implementation of complex innovation projects, in particular in the field of radical innovation.

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53 A. Smith, *Badania nad naturą i przyczynami bogactwa narodów*, PWN, Warszawa 1954.

54 E. Badger, *The Real reason cities are centers of innovation*, http://www.theatlanticcities.com/jobs-and-economy/2013/06/secret-why-cities-are-centers-innovation/5819/, publ. June 2013, access 20.05.2014.

55 Ibidem.

In the EU common policy high importance is attributed to the development of networks, which enable non-governmental organizations to work for economic prosperity and create an opportunity for[56]:

- mobilization of all the actors of economic development, activation of standing on the sidelines social groups, creating an atmosphere of mutual trust and common goals,
- the development of public-private partnerships and socialization of economic policy,
- the introduction of competition mechanisms for the use of public funds and reducing bureaucracy in development activities,
- combining public funds with private and obtaining external funds for development and infrastructural projects,
- the development of new forms of technology transfer, promotion of entrepreneurship and marketing.

Therefore, it is necessary to use a network approach to innovation management in cities. Innovations play an increasing role in the management of organizations, affecting changes in organizations. These changes are increasingly innovative and allowing for improvement throughout the organization and its individual components if they are introduced as planned and targeted action to obtain benefits.

Innovation in the development of territorial units is in the interest of researchers from many disciplines: urban planners, sociologists, economists and geographers. In their research, they seek to answer the question why in terms of the level of quality of life among many municipalities some develop better and faster than others, and what are the factors favouring the occurrence of such a phenomenon. The question is from where emerging:

1. institutional and organizational innovations as new public management, governance, networking, regional innovation systems, "learning" cities and regions, urban marketing and appointment of innovative city manager or Agenda 21 based on the participation of the residents,
2. product innovations, which include: city arcades, a new multi-purpose spaces, a new leisure infrastructure, innovation, urban transport systems, industrial zones for entrepreneurs, incubators, technological parks,
3. technical and technological innovations (electrisation, computerization, etc.)
4. innovations in financial management (e.g. public-private partnership in financing projects of the public sphere).

[56] K.B. Matusiak, *Zasoby i kierunki rozwoju...*, 2001, s. 252-254.

1.6. Innovation initiatives in cities

There are many examples of innovative activities in some cities of the World. In 2012 San Francisco Ed Lee new Mayor of San Francisco decided to create an Office of Innovation. He argued his decision as follows: "The need for innovation in government has never been greater, and we must work with our greatest resource – our human capital – to find new solutions to old challenges. San Francisco is home to some of the world's greatest talent, and through these and other innovation initiatives in 2012, we can start making government more accountable, accessible and responsive to our customers as the world's first City 2.0."[57] One of the first tasks of the Office of Innovation was project involving over 80 designers, technologists and business pros, all collaborating quickly and intensively to create viable solutions for the City's taxi distribution and transit communication problems. Jay Nath first Chief Innovation Officer knew one of his biggest challenges would be identifying and experimenting with all local community. He found fast that close to San Francisco is located Silicon Valley with thousands of startups, incubators, venture investors and several top universities including California College of the Arts (CCA), a leader in design innovation. All he needed was to induce them to cooperate.

Many cities around the world take initiatives related to innovation in different areas. The Authority of San Diego introduced a civic and Urban Initiatives program, a think tank to spur innovation and civic engagement. The main goal of initiative is to engage people living in San Diego for active participation in planning of their neighbourhood. It is expected that this helps to find new proposals in urban gardening or street stripping, and will make a big difference in the way neighbourhoods look and feel and operate.[58]

Some cities have begun to change their model from sprawled, functionally, economically and socially divided district to the new model called Innovation District Model, which clusters leading-edge anchor institutions and cutting-edge innovative firms, connecting them with supporting and spin-off companies, business incubators, mixed-use housing, office, retail and 21st century urban amenities.[59] Such changes can already be seen in cities such as Atlanta, Cambridge, Detroit, Philadelphia, San Francisco and St. Louis. In these cities around existing clusters of advanced research universities, medical complexes,

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[57] Ch. Ireland, M.A. Masterson, J. Nath, *Accelerating Innovation for the City of San Francisco*, April 28, 2012, http://www.managementexchange.com/story/accelerating-innovation-city-san-francisco, access 10.05.2014.

[58] http://voiceofsandiego.org/2013/10/24/filners-incubator-lives-on/ access 22.05.2014.

[59] B. Katz, *Big Idea 2014: Goodbye Silicon Valley, Hello Silicon Cities*, Brooking, http://www.brookings.edu/research/opinions/2013/12/30-silicon-cities-katz#, access 22.05.2014.

and tech and creative firms is observed fast business expansion as well as residential and commercial growth. In other cities such as Boston and Seattle are being re-imagined older, often underutilized industrial areas.

A city can be innovative in many different ways. There are many examples for innovation which can make a city more ecological and healthier for inhabitants. For example, City Chicago introduced new revolutionary material known as smog-eating cement. This innovative type of cement is capable of eradicating the air pollution, potentially reducing the levels of certain common pollutants by 20-70% depending on local conditions and the amount of exposed surface area – by breaking down the nitrogen oxides which are the result of burning fossil fuels.[60] This type of photocatalytic cement is ideal as paving material which can successfully reduce the amount of toxins expelled by vehicles and inhaled by pedestrians. This cement is a cost-effective way to make the urban environment cleaner and healthier.

Detroit is the most populous city in the U.S. state of Michigan. The city is also the main centre for business, financial and cultural centre in the metro Detroit area, a region of 5.2 million people. It is known worldwide as a traditional automotive centre, nick named as *Motor City* or *Motown*. In effect of the last financial crisis and the accompanying downturn in the automotive market Detroit has gone through a continuing economic decline. The ongoing decline caused urban decay and thousands of empty homes, apartment buildings and commercial buildings around the city and which in turn triggered difficulties in ensuring municipal services to the community. The city authorities were considering various solutions ranging from such radical ones as demolition of abandoned homes and buildings to encouraging the small population in certain areas to move to more populated locations. Regardless of the difficult financial and economic situation of the city, the authorities take a number of actions in the field of innovation, rightly reasoning that it is a good way to overcome the current city problems. This new approach, also used in other U.S. cities have already gained a name i.e. tactical urbanism. Detroit, like other cities have lot of space which can be more effectively used through their modernization and thereby giving great opportunities to enliven neighbourhoods with low-cost, high-value solutions. The tactical urbanism of Detroit lies in the fact that, they want to be more innovative with place making, community-driven projects. "These community-driven projects are often quick, cheap and temporary – powered by human energy and sweat equity more so than big-budget capital investments. What do we mean by "tactical?" Pop-up shops & cafes. Guerilla

[60] B. Porada, *Chicago, First U.S. City to Line Streets with Smog-Eating Cement*, "ArchDaily" 14 Apr 2013, http://www.archdaily.com/?p=359756, accessed 25 May 2014.

gardening. Chair bombing. Projects designed by and for the community that add vitality to a neighbourhood."[61]

The Urban Innovation Exchange is one of the initiatives whose aim was to involve the local community to work on innovations making places of living better designed to life. The goal of UIE initiative is to inform, engage and advance Detroit's growing innovation movement. Led by Issue Media Group with Data Driven Detroit, The Civic Commons and a coalition of media and community partners, the UIX is made possible thanks to funding from the John S. and James L. Knight Foundation. Now this is a platform for cooperation, exchange of ideas across the community of Detroit. Within three years of existence the UIX have surveyed community innovators to build a comprehensive database and collect the data about social attributes, perceptions of innovation, and the support systems that innovators access to start, scale, and sustain their projects. As a result they have a rich survey sample of 113 UIX-featured innovators representing one hundred ten innovative projects. It is important to note that for the purposes of this initiative, "innovation" and "social innovators" include a wide spectrum of characteristics, with survey subjects diversely self-identifying as artists, neighbourhood leaders, entrepreneurs and social entrepreneurs, technologists, community organizers and more.[62] As a result, after preliminary demographic and network analyses they formulated three important things they have learned from Detroit's innovators:

1. Social innovation in Detroit is rooted in place.
2. Networking and building relationships are an innovator's most essential skill sets.
3. Innovators are social people!

Another UIX initiative FoodLab[63] is a community of food entrepreneurs committed to making the possibility of good food in Detroit a sustainable reality. This is a network of triple-bottom line food entrepreneurs in the Detroit area, which are interested in common design, building, and maintaining a diverse ecosystem of triple-bottom-line food businesses as part of a good food movement that is accountable to all Detroiters. Their main goals of FoodLab are:

- sharing info, resources, and emotional support;
- organizing technical and financial assistance;
- learning to balance financial, social & environmental goals;
- and holding ourselves accountable to the commitments they make.

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[61] C. Nelson, *Let's Get innovative: tactical urbanism*, Detroit Urban Innovation Exchange, http://www.uixdetroit.com/features/tactical32112.aspx, access 20.05.2014.

[62] http://www.uixdetroit.com/features/threethingswevelearneduixd3.aspx, access 20.05.2014.

[63] J. Daniel, *FoodLab: Weaving the network for a good food system in Detroit*, publ. 13.02.2014, http://www.uixdetroit.com/features/foodlabnetworkweaving.aspx, access 20.05.2014.

The FoodLab is much "more than a good food business "incubator," is as *network weavers*, knitting together a diverse community of entrepreneurs and connecting this community into a broader movement that extends beyond just businesses"[64]. Entrepreneurs being in the network gather useful information from customers, collaborators or resource-providers and in their opinion these connections are their social *capital* that can be built over time.

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[64] Ibidem.

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Chapter 2

Smart and Eco2 city ideas

Stanisław Łobejko

2.1. Idea of smart city

The changes occurring now show that in the near future, the idea of a smart city becomes a reality. "Nowadays, the large and small districts are proposing a new city model, called "the smart city", which represents a community of average technology size, interconnected and sustainable, comfortable, attractive and secure."[65] We already see new directions in cities development: more efficient public transport, electric vehicles replace current autos reducing carbon emission, new buildings are more energy efficient and have a more efficient waste management. The technology allows today to reduce needs for travelling using instead tele-conferencing and video-conferencing. E-health, a home automation technology based on smart IT applications let older and disabled people stay home, while maintaining a good health care and increasing their social inclusion. "The potential of smart applications is boundless – personal health applications fixed to clothes or beneath the skin sending back constant streams of data to medical centres and providing real-time alerts or diagnoses; biometric identity devices; always-on access to social networks; and people-to-object digital connections."[66] In smart cities people will live in a clean, green environment as a result of using most advanced infrastructure systems to improve the management of water, gas, electric, food

[65] G.C. Lazaroiu, M. Roscia, *Definition methodology for the smart city model*, Energy, Vol. 47, November 2012, p. 326-332, www.elsevier.com/locate/energy, access 10.04.2014.

[66] P. Budde, *Smart Cities of Tomorrow, in: Cities for Smart Environmental and Energy Futures. Impacts on Architecture and Technology*, eds. S.Th. Rassia, P.M. Pardalos, Springer-Verlag Berlin Heidelberg 2014, p. 10.

supply, transport and communication. The implementation of such a noble goal requires the cooperation of all stakeholders of contemporary cities: authorities, residents, businesses, organizations and institutions of science. What is needed is a broad process of informing urban communities, encouraging their cooperation and activities in support of the smart city initiative. This process is also needed in order to increase the level of awareness of the needs of the rapid changes in the functioning of contemporary cities and understanding of smart cities idea. The smart city idea is based on three pillars[67]:

1. To make quality of life an excellence hub, to deliver service tailored to the citizen.
2. To promote the sustainable development throw harmonized management of public services, which will increase activity and generate savings on energy.
3. The work on economic development, so that the city remains an essential lever in the development of the new services and creation of innovative businesses and activities.

The idea of smart city is based on the extensive use of information and communication technology. "Tomorrow's digital cities will be the product of today's dreams."[68] In the twenty-first century will continue further convergence of information and communication technologies making urban environments quite different from anything that we have experienced hitherto. "Cities are becoming smart not only in terms of the way we can automate routine functions serving individual persons, buildings, traffic systems but in ways that enable us to monitor, understand, analyse and plan the city to improve the efficiency, equity and quality of life for its citizens in real time."[69] Researchers identified six Smart City initiatives[70]:

1. *The development of new cities badging themselves as smart.* These are proliferating in rapidly growing countries. Masdar outside of Abu Dhabi is being developed by GE as the world first carbon neutral city, Paredes in Portugal is where Microsoft are wiring an energy efficient city, Dongtan in the Yangtze Delta is being developed by Arup as a smart green eco-town,

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67 Ibidem, p. 11.

68 *Cities for Smart Environmental and Energy Futures. Impacts on Architecture and Technology*, eds. S.Th. Rassia, P.M. Pardalos, Springer-Verlag Berlin Heidelberg 2014, p. 9.

69 M. Batty, K. Axhausen, G. Fosca, A. Pozdnoukhov, A. Bazzani, M. Wachowicz, G. Ouzounis, Y. Portugali, *Smart Cities of the Future*, UCL Working Papers Series, Paper 188, October 12, 2012, https://www.bartlett.ucl.ac.uk/casa/pdf/paper188, access 12.04.2014.

70 M. Batty, K. Axhausen, G. Fosca, A. Pozdnoukhov, A. Bazzani, M. Wachowicz, G. Ouzounis, Y. Portugali, *Smart Cities of the Future*, UCL Working Papers Series, Paper 188, October 12, 2012, https://www.bartlett.ucl.ac.uk/casa/pdf/paper188, access 12.04.2014.

and Songdo in South Korea is where Cisco are building a town wired at all levels.

2. *The development of older cities regenerating themselves as smart*. In much more bottom-up fashion, which include many cities who are embedding new ICT as a matter of course. Examples of best practices are to be found in world cities where spontaneous development of new technologies are emerging in places as Silicon Alley (New York City), Silicon Roundabout (London) and Akihabara (Tokyo).
3. *The development of science parks, tech cities, and technopoles focused on high technologies*. Silicon Valley and Route 128 are the classic examples but the science park idea is still highly resonant with respect to local economic development where high tech production merges with its consumption in making such areas smart.
4. *The development of urban services using contemporary ICT*. In the form of networked data base, cloud computing and fixed and mobile networks, a force which is more central to our concerns here in coordinating diverse interests and sectors which will make the city smart in its design and planning.
5. *The use of ICT to develop new urban intelligence functions*. These are new conceptions of the way the city functions and utilize the complexity sciences in fashioning powerful new forms of simulation model and optimization methods that generate city structures and forms that improve efficiency, equity and the quality of life.
6. *The development of online and mobile forms of participation*. In which the citizenry is massively engaged in working towards improving the city alongside planners and designers from government and business. Decentralized notions of governance and community action are central to these new forms of participations which use extensive ICT.

Among many Smart City initiatives noteworthy among others are Songdo International Business District, an intelligent city near Seoul that's equipped with advanced sensors and monitors from Cisco Systems and Masdar City, in Abu Dhabi designed to be carbon free city. The case of Songdo was described John Kasarda and Greg Lindsay in the book Aerotropolis: The Way We'll Live Next[71]. They present Songdo as a very good example of smart, intelligent and fully "sensored' city, where all devices can be remotely both from your office or your home opened and closed, turned on and off, or stopped and started. The second famous example Masdar City is more scientific but in many ways, less

[71] J.D. Kasada, G. Lindsay, *Aerotropolis: The Way We'll Live Next,* March 1, 2011.

"intelligent" than Songdo. Sasskia Sassen describes Masdar City as "a laboratory, or what social scientists refer to as a natural experiment: a piece of real life that functions as a window, allowing us to learn about an abstract, complex condition (for example, a fully intelligent and green city) that we cannot replicate in the university laboratory."[72]

2.2. Smart cities in EU

The idea of a smart city plays an important role in the politics of the European Union, regarding energy efficiency, renewable energy and green mobility for the large urban cities.[73] This results from the fact that the European urban system is the main territorial structure and the cities are key drivers in the developments of regions. Therefore the European Commission encourages companies to invest in the development of low greenhouse gas emission technologies and high efficient and clean technology. It is related not only to economic and technological changes caused by the globalization but also connected with the integration process, causing that cities in Europe face the challenge of combining competitiveness and sustainable urban development simultaneously. The main challenge facing European cities is improving urban living quality including housing, economy, and culture, social and environmental conditions. In particular, the medium-sized cities, where the majority of the population lives. The medium-sized cities will have to compete with larger metropolis, wherein they are substantially weaker in context of critical mass, resource and organizing capacity. To continue to grow these cities should identifying their strengths and chances for positioning and ensuring the comparative advantages in certain key resources, against other cities of the same level and ranked against them. Regarding the EU project's aim and its duration, the city should fulfil two base criteria:

- cities should be of medium size and
- they should be covered by accessible and relevant databases.

In practice there are many different rankings based on different indicators and methodology approaches causing often the situation that one city is ranked very differently in various rankings. Many medium-sized cities often are not at

[72] S. Sassen, Talking back to your intelligent city, http://voices.mckinseyonsociety.com/talking-back-to-your-intelligent-city/, access 12.04.2014.

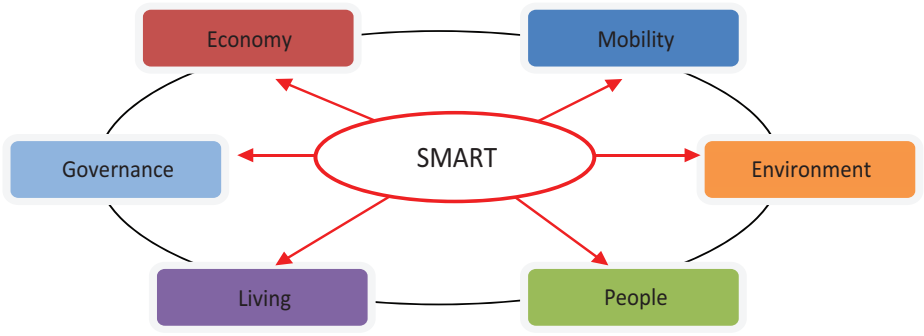
[73] *European Smart Cities*. Centre of Regional Science Vienna University of Technology; 2012. Available from: http://www.smart-cities.eu/model.html, access 11.04.2014.

all recognized on global level.[74] The most comprehensive list of cities in Europe is provided by the Espon 1.1.1 project.[75] Among all European cities 1600 cities in the Espon space (EU27 + NO + CH) are covered, with data on population and some functional data. A "smart city" can be well described by 6 built on the 'smart' combination of endowments and activities of self-decisive independent and aware citizens characteristics[76]:

a. smart economy
b. smart mobility
c. smart environment
d. smart people,
e. smart living
f. smart governance

The smart city model can be presented graphically.

Figure 1. Model of smart city



Source: *Smart cities. Ranking of European medium-sized cities*, Final Report, October 2007, http://www.smart-cities.eu/download/smart_cities_final_report.pdf, and access 11.04.2014.

We have to remember that an International and European agreement on smart city indicators has not been found because smartness is always not easy to measure. But existing proposals allow to benchmark a city against other

[74] The "Urban Audit" data collection provides information and comparable measurements on the different aspects of the quality of urban life in European cities, http://epp.eurostat.ec.europa.eu/portal/page/portal/region_cities/city_urban/, access 11.04.2014.

[75] European Union. European observation network for territorial development and cohesion (ESPON). Brussels: EU Commission. Available from: http://www.espon.eu/main/Menu_Projects/Menu_ESPON2006Projects/Menu_ThematicProjects/ 2012, access 11.04.2014.

[76] G.C. Lazaroiu, M. Roscia, *Definition methodology for the smart city model*, "Energy", Vol. 47, November 2012, p. 328, www.elsevier.com/locate/energy, access 10.04.2014.

cities in the scope of their smartness. The aggregated data about European cites can be found on the Eurostat websites.[77] More detailed information about benchmarking of medium-sized European smart cities can be found in the report: *Smart cities – Ranking of European medium-sized cities*.[78]

2.3. Future smart city

The idea of smart cities is still being developed, there are many researches conducted and new models developed. Such a new idea is named as a future smart city (FSC) which is based on the assumption that reduction of Co2 can be achieved by combining appropriate land use (compact city with energy efficient buildings and photovoltaic panels (PVs)), transportation (electric vehicles (EVs) and public transportation system) and energy systems (smart grid systems), because of the interaction between these elements. An interesting model was developed for the Tokyo metropolitan area, which is the largest Mega city in the world. In this integrated approach a spatially explicit land use model (urban economic model) was constructed for the study area, and the model was calibrated basing on existing statistical data. In modelling process city scenarios for the year 2050 were created. Next was carried out the analysis of, intra-day dynamics (hourly) of electricity demand and supply from PVs, which can be installed on roofs. The results of modelling suggest that[79]:

1. ''compact'' urban form may contribute to the reduction of electricity demand from the residential sector, but
2. PV-supply under the scenario may also be reduced because of the decreased share of detached houses.

In the compact city scenario, it is important to discuss the effective use of vacant areas in suburbs, which may be used for large PV installations, or be re-vegetated to mitigate urban heat island effects.

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77 http://epp.eurostat.ec.europa.eu/portal/page/portal/region_cities/city_urban/urban_audit_data_collections access 11.04.2014.

78 *Smart cities. Ranking of European medium-sized cities*, Final Report, October 2007, http://www.smart-cities.eu/download/smart_cities_final_report.pdf, access 11.04.2014.

79 Y. Yamagata, H. Seya, Simulating a future smart city: An integrated land use-energy model, Applied Energy 112 (2013) 1466-1474, http://www.sciencedirect.com/science/article/pii/S030626191300072X, access 11.04.2014.

2.4. Idea of Eco2 City

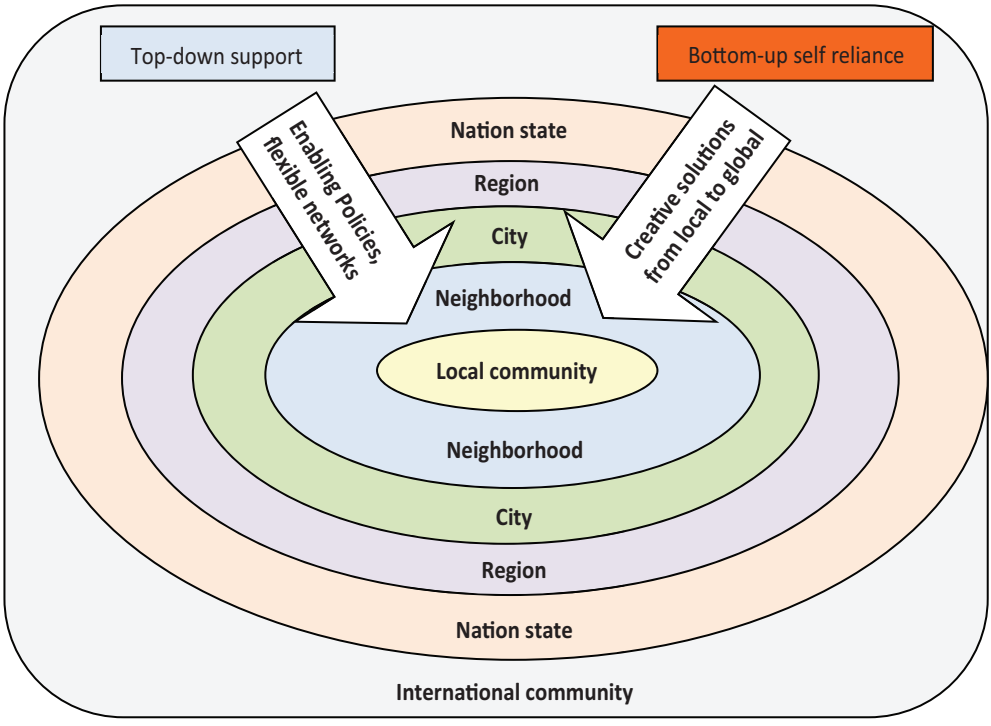
In recent years we have seen a lot of activities undertaken by various organizations and institutions whose goal is to promote new initiatives of ecological urban development. Such a new important initiative is Eco2 Cities which was launched by the World Bank, as an integral part of the World Bank Urban and Local Government Strategy. An Eco2 City is the city skilfully employing to its healthy growth the synergy and interdependence of ecological and economic sustainability. The main goal of Eco2 initiative is to help cities in developing countries achieve greater ecological and economic sustainability. This initiative is a response to the challenges it brings. Dynamic urbanization, induced by an increasing number of inhabitants of towns and facing especially developing countries is a great challenge. In response to a big wave of urbanization societies need to change their previous attempt to urban development for a new approach based on ecology and based on systematic learning from global best practices. We all need to know how we can reconcile grooving urbanization with accompanying negative impact on biological environment. The Eco2 initiative is trying to find the best way for growing scale of urbanization on the Earth and high rates of sustainable economic and social growth with respect to the environment. This way seems to be the involvement of citizens and society in process of integrated urban planning and management oriented on the benefits of ecological systems, and protecting environmental assets for future generations. The initiative Co2 is therefore supporting the development of ecological and economical cities. If the city is economical, then it creates value and opportunities for citizens, businesses, and society by efficiently using all tangible and intangible assets, and enabling productive, inclusive, and sustainable economic activity. It is good, however, not only for inhabitants but also for the global society, if the economical city is also ecological. The Idea of Eco2 city presupposes the synergy and interdependence of ecological and economic sustainability, and strong influence on the living conditions in cities. "Innovative cities in both the developed and the developing world have demonstrated that with the appropriate strategic approach they can economically enhance their resource efficiency – realizing the same value from a much smaller and renewable resource base – while simultaneously reducing harmful pollution and unnecessary waste."[80] Through this approach Eco2 city can improve the quality of life of their inhabitants, and enhance their economic competitiveness simultaneously creating an enduring culture of sustainability.

[80] Eco2 Cities: Ecological Cities as Economic Cities, p. 2, http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1270074782769/Eco2Cities_synopsis.pdf, access 16.04.2014.

The emphasis given to integrated solutions and change management distinguishes Eco2 Cities from previous approaches and we can say that Eco2 City represents a second generation of an eco-city because it is focused not only on ecological performance alone and good practices but also strongly encourages cities to adopt a holistic framework for analysis taking into account also economic aspects. "Eco2 City also embraces a highly participatory process for managing change at all levels of decision making bodies and across all sectors."[81]

The Eco2 Cities Initiative offers for cities an analytical and operational framework that can be applied and contextualized to the particular challenges of each city. It includes special methods and tools which can be adapted and used in city planning, development and management.

Figure 2.2. The bottom-up city based approach



Source: Source: ECO2 Cities: Ecological Cities as Economic Cities, p. 5, http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1270074782769/Eco2Cities_synopsis.pdf, access 16.04.2014.

[81] Ibidem, p. 7, http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1270074782769/Eco2_Cities_Guide-web.pdf, access 16.04.2014.

The first principle – a city based approach – is concentrated on two assumptions: 1. cities are now at the front lines for managing change and leading an integrated approach, 2. cities depend on their natural landscapes to provide food and recreation, capture and store water and energy, absorb wastes, and satisfy many other needs. The main goal is steady protecting and enhancing ecological assets of the city, which is a valuable natural capital of the city, and allows further development. City planning process should be strongly targeted on protecting and regenerating the irreplaceable natural capital, especially the natural assets of the region in which the city is located. The city based approach involves active engagement in the process of development planning of the city both local government and local society. But first of all it should be a bottom-up approach in which the local level generates creative self-reliant solutions, while the top-down supports at the local government level of the cities implementation of proposed solutions.

2.5. System approach

Cities are complex organisms of social, technological and organizational relations, between all stakeholders, e.g. city residents, businesses, organizations and local government. These include both humans as well as buildings and urban infrastructure and its surroundings placed in the natural environment. Each city is a complex administrative and economic organization and proper planning and management of city development requires a systemic approach. In the frame of the systemic approach there is a need for a platform of mutual understanding, entailing collaboration at the scale of the entire urban area or region. This can apply to issues like the development of new land, or metropolitan management, and may necessarily involve local governments, key private sector partners and citizens. At each of these levels, very different types of collaboration are necessary in different cooperating groups in a city-led collaborative process. "The planning framework can be a powerful platform for collaborative design and decision-making and can enable the city to steer the efforts of all stakeholders toward a commonly agreed upon vision."[82] When the formal collaborative process begins, it also offers the opportunity for much more intensive participation on other initiatives and related projects.

In every system some subsystems which are individual component parts of the whole system can be distinguished. The idea of systems thinking enables

[82] Ibidem, p. 6, http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1270074782769/Eco2Cities_synopsis.pdf, access 16.04.2014.

reduction of system complexity by understanding how all the parts fit into the system. A one system approach allows to plan, design, and manage the whole urban system by integrating and optimizing its key subsystems. Although the one system approach has many dimensions, it is not much complicated and is easy to implement in practice. The one system can be used as a tool for integration within a sector or across sectors and can be applied to policies, plans, sequencing of financial mechanisms and their various combinations. "In exploring the possibilities for a one system approach, cities first analyse its urban forms and consider spatial planning, land use, density, connectivity, proximity, and other attributes of urban form. Next, cities address the enhancement of the efficiency of resource flows in an urban area through integrated infrastructure system design and management."[83] Using one system approach allows cities to integrate urban form and urban flows, which is very important for sustainable development of urban areas. Integration enables not only seeing the full scope of elements that make up the city but also to evaluate how these different elements are connected, and how changes in one element can affect the others. This system perspective is very helpful for designing and managing cities so that they can become very efficient and very adaptive, in the same way as natural ecologies do. City systems are very similar to the ecological systems and demonstrate powerful strategies for managing change, such as succession and evolution, self-organization, and adaptive management. Such strategies can be used for improving the efficiency of the system as a whole and help the system adapt to change. For the innovative they also have still growing potential for lowering the cost and to recover quickly and fully from many different shocks and in effect enables city sustainability. There are many examples of one system approach implemented in practice. Some of them can be found in paper *Eco2 Cities: Ecological Cities as Economic Cities*[84].

In Eco2 initiatives many ecological assets are very important, among them green areas, which offer to the city valuable services and economic benefits in several ways, like for example[85]:

- They provide natural drainage (results in avoided infrastructure capital and maintenance costs, and reduces seasonal losses related to flooding).
- They can reduce the average temperature in cities (this reduces peak load demand electricity, which can result in avoided capital costs for installed power as well as related operation and maintenance cost).

[83] Ibidem, p. 7, http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1270074782769/Eco2Cities_synopsis.pdf, access 16.04.2014.

[84] Ibidem, p. 16-17, http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1270074782769/Eco2_Cities_Guide-web.pdf, access 16.04.2014.

[85] Ibidem, p. 10, http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1270074782769/Eco2Cities_synopsis.pdf, access 16.04.2014.

- They absorb carbon dioxide and release oxygen, are natural air cleaners, and support overall citizen health.
- They can be integrated into the public transport system as a network of bike paths and pedestrian walkways to enhance utility.
- They have generally been shown to increase physical and mental well-being, while creating a sense of community and reducing crime.

The above-mentioned four principles define the scope of each city's unique Eco2 pathway, leading directly from one or more of the principles and the connections to achieve the desired result. At any time and at any stage of this pathway the city can be based on principles. The analytical and operational city development framework emerges from the principles. Each principle consists of a set of core elements creating a platform for activity and learning and providing specific information on new concepts and on the roles and responsibilities of Eco2 cities and their partners. All that can be concluded as "All cities want to benefit from good urban and spatial planning. It is up to city leaders to determine whether the Eco2 program is the kind of pathway they are seeking."[86]

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Chapter 3

New Urbanism – concept and models

Stanisław Łobejko

3.1. Idea and main principles

The urban form, named as Neotraditional Development and known as New Urbanism was formed as a result of searches for better than traditional urban forms based on some of their physical qualities. The new urbanism is the best known among the neotraditional approaches to city planning and described as a new approach to designing cities, towns, and neighbourhoods. New urbanism advocates design-based strategies based on traditional urban forms in order to reduce suburban sprawl and stop inner-city decline and to build new and renew old neighbourhoods and cities. A key new urbanism development strategy is to support urban development that preserves open space and ecological integrity of land and water. It may be achieved "through a wide variety of means including urban consolidation, various methods to reduce traffic and urban heat island effect, encourage greater use of renewable energy, green roofs and public transport, a holistic approach to nature, history, heritage, health and safety, and a life cycle approach to energy, resources and waste."[87] If we look at the assumptions of the new urbanism and the idea of eco-city, they have many common elements, as for example: effective transport and transit, walkability, environmental sustainability and social integration. Supporters of the new urbanism argued that despite the fact that new urbanism is simply an approach to planning and design that draws on historical precedents the new approach let designers satisfy residents, encourage local walking and use, support pleasing neighbourhood contacts, and bolster a strong sense of community,

[87] Eco-city planning policies, practice and design, eds. T.-Ch. Wong, B.K.P. Yuen, Springer, Dordrecht 2011, p. 4.

while increasing residential densities beyond the suburban norm.[88] Although the term New Urbanism emerged during the late 1980s and early 1990s, the principles of New Urbanism are actually quite old. For a long time New Urbanist town planners, developers, architects, and designers try to reduce traffic and eliminate sprawl.[89]

The new urbanism strongly emphasizes certain concepts of sustainable urban form, like for example[90]:

1. In *transport,* neotraditional development suggests pedestrian orientation and walkable villages.
2. In *density,* it promotes higher residential densities than typical suburbs.
3. In *mixed land uses,* it suggests a mix of residential, commercial, and civic uses.

Planned under this idea residents of new neighbourhoods can walk to shops, businesses, theatres, schools, parks, and other important services. Buildings and recreational areas are designed according to the principles of earth-friendly architecture, energy conservation, historic preservation and fostering a community closeness. Ideas of new urbanism are promoted by founded by Peter Katz in 1993 a group of followers which outlined their beliefs in an important document known as the Charter of the new Urbanism. The document states as follows: The Congress for the New Urbanism views disinvestment in central cities, the spread of placeless sprawl, increasing separation by race and income, environmental deterioration, loss of agricultural lands and wilderness, and the erosion of society's built heritage as one interrelated community-building challenge. Congress participants have undertaken a set of principles to guide public policy, development practice, urban planning, and design of the metropolis, city and town[91]:

1. Metropolitan regions are finite places with geographic boundaries derived from topography, watersheds, coastlines, farmlands, regional parks, and river basins. The metropolis is made of multiple centres that are cities, towns, and villages, each with its own identifiable centre and edges.

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88 M. Leccese, K. McCormick, *Charter of the new urbanism*, McGraw-Hill, New York 2000, Second edition Charter of the new urbanism, ed. by E. Talen, McGraw-Hill, New York 2013.

89 http://architecture.about.com/od/communitydesign/g/newurban.htm, access 15.04.2014.

90 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.

91 http://architecture.about.com/od/communitydesign/a/urbanismcharter.htm, access 15.04.2014.

2. The metropolitan region is a fundamental economic unit of the contemporary world. Governmental cooperation, public policy, physical planning, and economic strategies must reflect this new reality.
3. The metropolis has a necessary and fragile relationship to its agrarian hinterland and natural landscapes. The relationship is environmental, economic, and cultural. Farmland and nature are as important to the metropolis as the garden is to the house.
4. Development patterns should not blur or eradicate the edges of the metropolis. Infill development within existing urban areas conserves environmental resources, economic investment, and social fabric, while reclaiming marginal and abandoned areas. Metropolitan regions should develop strategies to encourage such infill development over peripheral expansion.
5. Where appropriate, new development contiguous to urban boundaries should be organized as neighbourhoods and districts, and be integrated with the existing urban pattern. Noncontiguous development should be organized as towns and villages with their own urban edges, and planned for a jobs/housing balance, not as bedroom suburbs.
6. The development and redevelopment of towns and cities should respect historical patterns, precedents, and boundaries.
7. Cities and towns should bring into proximity a broad spectrum of public and private uses to support a regional economy that benefits people of all incomes. Affordable housing should be distributed throughout the region to match job opportunities and to avoid concentrations of poverty.
8. The physical organization of the region should be supported by a framework of transportation alternatives. Transit, pedestrian, and bicycle systems should maximize access and mobility throughout the region while reducing dependence upon the automobile.
9. Revenues and resources can be shared more cooperatively among the municipalities and centres within regions to avoid destructive competition for tax base and to promote rational coordination of transportation, recreation, public services, housing, and community institutions.

Congress participants also agreed on the planning principles of the neighbourhood, the district, and the corridor. The third group of congress findings are related to planning of block, street, and building.[92]

[92] http://architecture.about.com/od/communitydesign/a/urbanismcharter.htm, access 15.04.2014.

The best known examples of cities built in accordance with New Urbanism are:

1. Celebration, Florida; http://architecture.about.com/od/plannedcities/ss/celebration.htm
2. Loreto bay, Mexico, http://architecture.about.com/od/plannedcities/a/loretobay.htm

3.2. Transit-oriented development

The transit-oriented development (TOD) is another type of a new urbanism form that is also based on the neotraditional form of development. Various other terms have surfaced over the years to convey the idea of TOD, such as "transit village," "transit-supportive development," and "transit-friendly design". Most definitions of TOD have several common elements, like for example: mixed-use development, development that is close to and well served by transit, and development that is conducive to transit riding. In other words we can say that TOD planning means developing or intensifying residential land use near rail stations and that way decreasing their dependence on driving.

Another example of the TOD is the *transit village*, which means "a compact, mixed-use community, cantered around a transit station that, by design, invites residents, workers, and shoppers to drive their cars less and ride mass transit more. . . . The centrepiece of the transit village is the transit station and the civic and public spaces that surround it."[93] A transit village can be defined as a predominantly residential area with some nearby retail activities planned around such as a train station, with the intent to make it convenient for village dwellers to get to/from work or run errands and travel via a public transportation network.

Quite different is another model of neotraditional development named *urban village*. The urban village model appeared first in the early 1980s in the United States and in the late 1980s in the United Kingdom. In urban planning and design, an urban village is an urban development typically characterized by medium-density housing, mixed use zoning, good public transit and an emphasis on pedestrianization and public space. According to the Urban Villages Forum, an urban village is a settlement created on a Greenfield or brownfield site, or out of an existing development. In turn a working definition of Bellingham Urban Villages states: Urban Villages are activity centres that provide pleasant living, shopping, and working environments; strong pedestrian accessibility;

[93] M. Bernick, R. Cervero, *Transit villages for the 21st century*, McGraw-Hill, New York1997, p. 5.

adequate, well located open spaces; an alternative, well connected street system; and a balance of retail, office, residential and public spaces.[94]

The rapid urban development sprawl caused a need for urban containment policies directed to enactment of regulatory urban growth boundaries. These restrictions caused new residential development in agricultural areas in form of restricting the numbers of new residential permits issued, land preservation programs, tax incentives, and a variety of other measures. Among methods used in frame of urban containment are such as: *greenbelts, urban growth boundaries* and *urban service areas. Greenbelts* are a spatial technique for containment, addressed to prevent open space areas, or areas of significantly reduced development. Very often greenbelts are created by public or non-profit purchase of open space lands to prevent them against building developments. They are devoted and designed as buffers to protect areas of land or water resources from development impacts. Often they play a role of wildlife corridors, helping to preserve wildlife and ecosystems even in areas with significant adjoining development areas. There are severe urban containment strategies focused on control the spatial pattern of development within a community or region. Another way to prevent excessive urban sprawl are *urban growth boundaries* (UGBs) defining limits on land development to curb sprawl, protect open space, or encourage the redevelopment of inner-city neighbourhoods. Urban growth boundaries are essentially a concept and planning tool helping the fast growing communities via specially established growth boundaries, redirect their growth and development in accordance with the community's natural environment and protect important natural, social and cultural resources. The boundaries can also find a way of more efficient and cost effective development of a public and community infrastructure supporting future city growth and development."

3.3. Compact City and Alternative City Models

Another often discussed form of urban development is the idea of a compact city. The Compact City or city of short distances is an urban planning and urban design concept, which promotes relatively high residential density with mixed land uses. On the one hand, it lets develop an efficient public transport system and encourages walking and cycling, low energy consumption and reduced pollution and on the other hand, it provides opportunities for social interaction as well as a feeling of safety. The compact city strategy aims to create compactness and density that can avoid all the problems of city sprawl and support of its

[94] www.cob.org/documents/planning/urban-villages/what-is-an-urban-village-summary.pdf, access 15.04.2014.

sustainable development. Many researches indicate that compact cities offer opportunities to reduce fuel consumption for traveling, since work and leisure facilities are closer together. Additional strong reasons for compactness of the city is saving the rural land without impairing a good quality of life even with high concentrations of people.[95]

There are also other researchers arguing against the compact city highlighting that compactness of the city itself does not solve all the problems faced by the modern city "because it does not reflect the hard reality of economic demands, environmental conflicts and social context"[96]. According to them, it is uncertain whether the Compact City Model will solve problems such as low density, single-use, automobile dependent type of development. It is difficult not to agree with the fact that the idea of a compact city also has its limitations. Therefore, the researchers looking for other models better illustrate the different urban patterns for a city development. Among many other models the following submodels can be mentioned[97]: Core City, Star City, Satellite City, Galaxy of Settlement, Linear City, and regional city model or polycentric net.

The Core City model is undoubtedly the most extreme model of a compact city with very high density and all the city's functions are placed in a small area built-up with multi-storey apartments rather than single family houses, a limited number of which may be located in specific city districts.[98] The Core City advantages rely on reduced distances for materials, goods and services resulting in lower needs for movement. Also distances between facilities, workplaces and residences are very short, which allows overcoming the distance on foot. But we have to count that such very high density generates some negative effects like discomfort of living in the form of noise and poor climate, small green spaces and possibility of massive congestion. The need for a second home in the country by the families residing in the core city may also occur.

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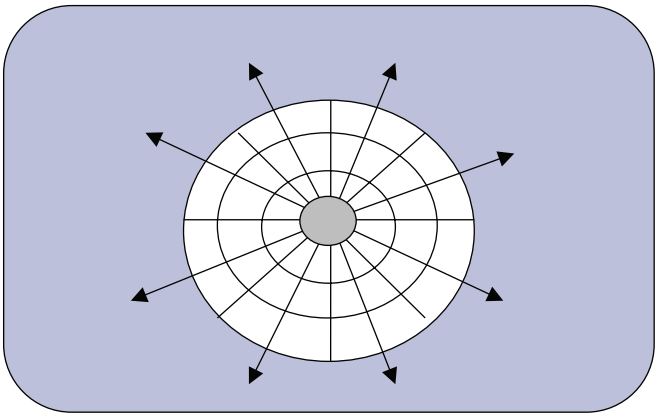
95 Y.R. Jabareen, *Sustainable Urban Forms. Their Typologies, Models, and Concepts*, "Journal of Planning Education and Research", September 2006, vol. 26 no. 1, p. 46.

96 Z. Tang, T. Wei, *The history and evolution of Eco-city and Green Community*, in: *Eco-city and green community. The evolution of Planning Theory and Practice*, ed. Z. Tang, Nova Science Publishing, Inc., New York 2010, p. 20.

97 Ibidem, p. 20-23.

98 H. Frey, *Designing the City: Towards a More Sustainable Urban Form*, Taylor & Francis e-Library 2005, p. 72.

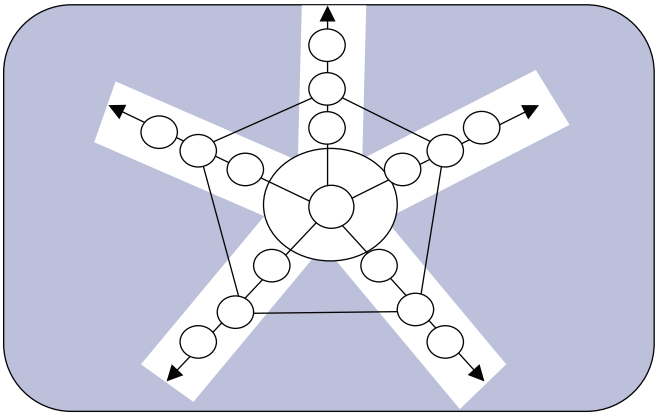
Figure 3.1. The Core City Model



Source: H. Frey, *Designing the City: Towards a More Sustainable Urban Form*, Taylor & Francis e-Library 2005, p. 72.

Another proposed by Lynch[99] city model is a Star City (or urban star model), with a single dominant centre as well as its own transportation system. The dominant centre model is accompanied by secondary centres which can be high or medium density. The transportation system provides fast communication between centres. According to Lynch a star city model allows the city to develop in its area and size much further than Core City model.

Figure 3.2. The Star City Model



Source: H. Frey, *Designing the City: Towards a More Sustainable Urban Form*, Taylor & Francis e-Library 2005, p. 75.

[99] K. Lynch, *Good city form*, MIT Press, Boston 1984.

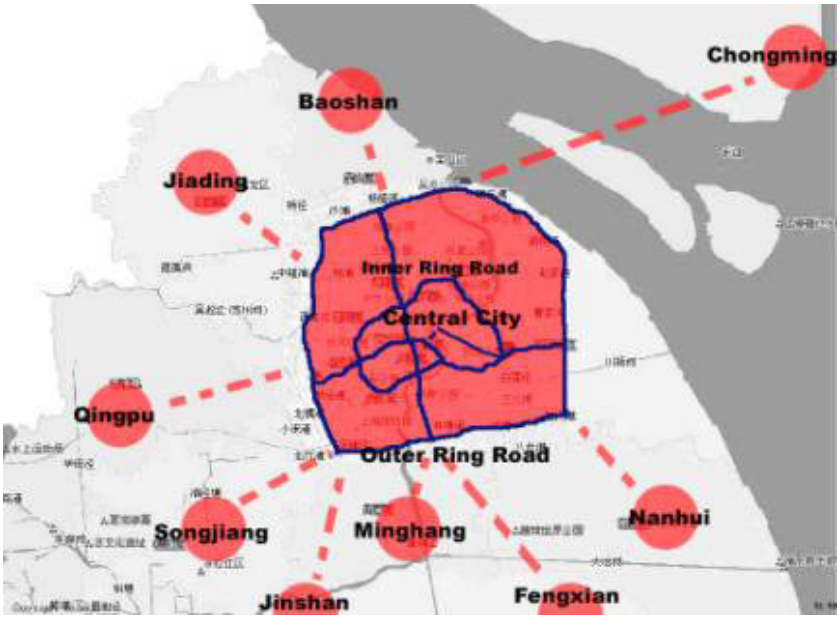
In the Satellites City Model a central city is surrounded by a set of satellites towns or communities of limited size. Satellites communities are placed in some distance from the central city and surrounding the city. They take the form of smaller metropolitan areas which are separated from the central city by rural land acting as greenbelts. Satellite City Model "presents a new pattern of city development that of self-contained and self-sufficient but linked centres, separated by agricultural land that supports them and provides the opportunity of a symbiosis with the natural environment. The main difference between sprawling cities and Satellites City Model lies in the independency of the communities. The Satellite towns are not bedrooms for a central city but functioning as independent cities, with their own functions in field of employment, city transport, and cultural centres as well as an independent municipal government. E. Howard proposed as first such a type of city model development in 1898 in his Garden City concept.[100] It is very interesting that Howard's Garden City model has a structure of Satellite City and his characteristics respond to the sustainable city requirements: "decentralization of the core city's function to generate all needed local services and facilities in each Garden City, and in the farmland surrounding it; decentralization of responsibility and participation of the communities in the process of shaping and building their own cities according to their needs and aspirations; a symbiotic relationship with the country side; a considerable degree of open-endedness ad flexibility of development; and virtually unlimited growth of the pattern to any metropolitan size"[101]. In France the idea of satellite cities was concerned in scope of urban planning policy issue of Paris in 1965. They start to build five satellite cities 25-30 kilometres around Paris, each with population of between 200,000 and 300,000, and finished in 1970s. Many people were engaged in construction of satellite cities and were themselves their future residents. Residents enjoyed a quality of life comparable with Paris' urban area. The cities become autonomous and independent from the central city, creating local government and administration. As a contemporary embodiment of the idea can be used the case of Shanghai's model "One City, Nine Towns" implemented in 2001. In this case Shanghai municipality decide to build nine satellite towns in European and North American style. Today after a decade a crown of pseudo-historical, pseudo-regional and pseudo-European towns surrounds Shanghai, connected with the central city via subways and highways. However, due to the financial crisis and the increase in property prices in China

[100] http://upload.wikimedia.org/wikipedia/commons/thumb/3/3d/Garden_City_Concept_by_Howard.jpg/575px-Garden_City_Concept_by_Howard.jpg, access 14.05.2014.

[101] H. Frey, *Designing the City: Towards a More Sustainable Urban Form*, Taylor & Francis e-Library 2005, p. 77-78.

these satellite towns are only partially populated and may be a prime example of situation when government force the model solution without support of local community.[102]

Figure 3.3. Nine satellite towns surrounding Shanghai



Source: http://hhhnz.freewebspace.com/images/p6.htm29.jpg

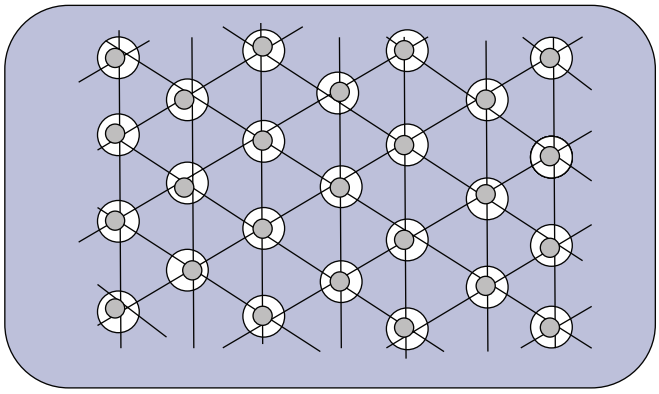
Another one model proposed by Lynch based on existing old centres and sub enters is the Galaxy and Settlement model. Centres of today's city as dispersed into small units linked by transportations and communication network. This model encourages decentralization of city to the small dense central cores separated by low-density suburban areas or open land. This approach combines the specific features of two models: a satellite city and a star city. Although the model is highly theoretical, it has strong influence on contemporary planning theories. "The Galaxy of Settlement model provides a modern vision for traditional towns and further develops traditional towns in regional context because it believes that the traditional towns should not just be self-sufficient."[103]

[102] *Shanghai satellite towns*, movingcities.org, published online 11.09.2012, http://movingcities.org/movingmemos/bauwelt-shanghai-satellite-towns/, access 15.05.2014.

[103] Z. Tang, T. Wei, *The history and evolution of Eco-city and Green Community*, in: *Eco-city and green community. The evolution of Planning Theory and Practice*, ed. Z. Tang, Nova Science Publishing, Inc., New York 2010, p. 20.

This concept in a certain sense, refers to the traditional neighbourhood developments (TDNs) of small size of about 80 ha inhabiting between 3000-6000 people, with the mean 10 min walking distance between the city edge and centre.

Figure 3.4. The Galaxy of Settlements Model

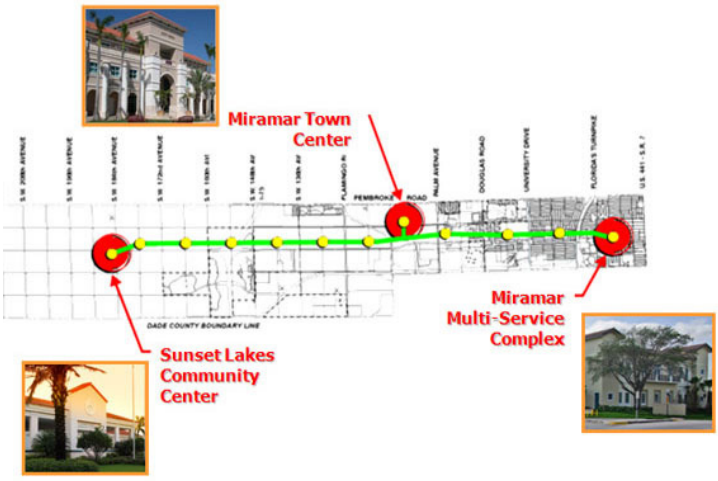


Source: Source: H. Frey, *Designing the City: Towards a More Sustainable Urban Form*, Taylor & Francis e-Library 2005, p. 79.

In the Linear City model towns grow along a continuous transport line, ideally public transport, or a parallel series of lines. This model is more dynamic than Core City regarding the specialized functions of each city. The major urban activities such as production, residence, commerce and services are developing along and on either side of the communication lines and, specially, from dense nodes at transport stops. High density use areas are separated by areas of less intensive use or rural land. Miramar in Florida is a good example of linear city model development. To meet the challenges of the fast population and development growth the City has experienced and the linear geographical shape of Miramar, the City Commission decreed that three strategically located Community Centres were necessary to serve the needs of the City. These centres are: Town Centre, Sunset Lake and Multi-Service Complex.

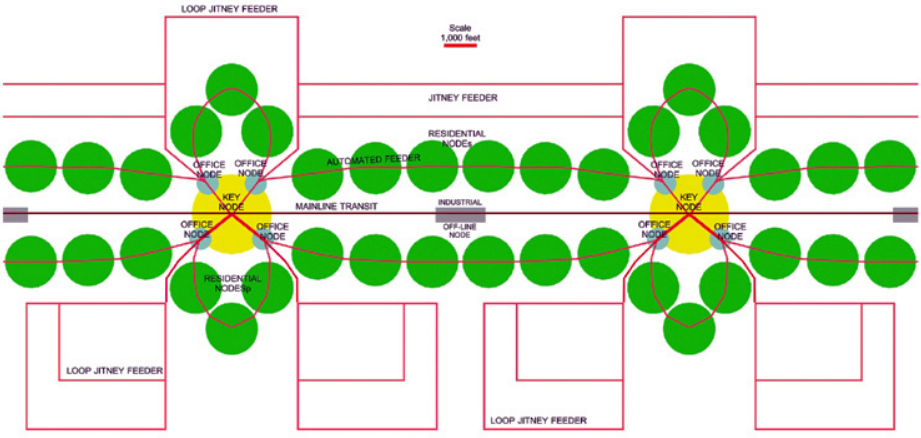
Polycentric Linear City (PLC) model is a new proposal for a polycentric corridor growth strategy developed strictly around a transit-based intermodal transportation network. Easy access to communication nodes close to (or in) the urban centres reduce the need for auto use. It provides a new possibility for existing urban forms and a new opportunity for city development and human settlements.

Figure 3.5. Linear model of Miramax in Florida



Source: *The City of Miramar Florida*, http://www.ci.miramar.fl.us/towncenter/centers.html, access 16.05.2014.

Figure 3.6. Polycentric Linear City Model: a prototype for a transit based human settlement



Source: http://www.linearcity.org/rufo/pts-01.htm, access 15.05.2014.

In many high density large metropolises in the world extensive and intensive rapid transit networks, mainly underground, are the base method of communication used by the inhabitants. Congestion and high parking costs discourage people from using cars. Rapid evolution of transit technology eliminates the nuisance of public transport and have proved the following[104]:

[104] http://www.linearcity.org/rufo/pts-01.htm, access 15.05.2014.

- Very high frequency of service, both peak and off-peak, without the high operation costs typically associated.
- The ability to operate at very low levels of noise and vibrations, both internal and external.
- The ability to perform safely and efficiently in fully automated control and operation.
- Ability to effectively operate small vehicles and single-vehicle trains.
- Extremely good safety records.
- Cost efficient use of non-polluting and silent propulsion technologies.
- Comparatively low capital and operational costs.

This corridor growth strategy can be overlaid over existing metropolises or cities of over one million in a variety of ways to accommodate, stimulate or direct regional growth[105]:

- As a linear development linking opposite sub-centres through the CBD.
- As a radial corridor development strategy through existing auto-based developments
- As an overlay on existing transit corridor
- As a new transit beltway linking major sub-centres.
- As a comprehensive new corridor development plan through mainly Greenfield sites.
- As a combination of any of the above.

Lynch proposed also another city development model known as Regional City or Polycentric Net.[106] In the 20th century many mega-city-regions developed according to the principles of the polycentric model in form of a cluster of cities, towns, and communities. These cities are separated but also intensively connected by transportation and communication corridors encouraging their cooperation. In the US, the mega major-city-region includes: Boston-New York City-Philadelphia-Baltimore-Washington, Los Angeles-San Diego-Tijuana and San Jose-San Francisco-Oakland-Sacramento. These metropolis have a specialized and complex circulation system taking on the form of a triangular grid pattern that can grow in any direction. The region is characterized by different density, higher in the odes of transport lines and linear lines and lower in other areas. Central city activities is decentralized to cities in nodes with different densities and degree of specialization. Regional City or Polycentric Net Model combines many of previous mentioned city models as even core city, star

[105] http://www.linearcity.org/rufo/pts-01.htm, access 15.05.2014.

[106] K. Lynch, *Good city form*, MIT Press, Boston 1984.

city, linear and polycentric model. "All in all, the fact that city models all score reasonably well under different weighting may mean that all of them may work well on their own or in combination to become a sustainable city region."[107]

3.4. Principles of Green Urbanism

Green urbanism has been defined as the practice of creating communities beneficial to human and the environment. It is a new 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.[108] It promotes the development of socially and environmentally sustainable city districts. Green urbanism is interdisciplinary, combining 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.[109] In his revolutionary book "*Green Urbanism*, *learning from European cities"* Timothy Beatley describes the cities applying the principles of green urbanism as follows[110]:

- Cities that strive to live within their ecological limits, fundamentally reduce their ecological footprints, and acknowledge their connections with and impacts on other cities and communities and the larger planet.
- Cities that are green and that are designed for and function in ways analogous to nature.
- Cities that strive to achieve a circular rather that a linear metabolism, which nurtures and develops positive symbiotic relationships with and between its hinterland (whether that be regional, national, or international).
- Cities that strive toward local and regional self-sufficiency and take full advantage of and nurture local/regional food production, economy, power production, and many other activities that sustain and support their populations.
- Cities that facilitate and encourage more sustainable, healthful lifestyles.
- Cities that emphasize a high quality of life and the creation of highly liveable neighbourhoods and communities.

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107 Z. Tang, T. Wei, *The history and evolution of Eco-city and Green Community*, in: *Eco-city and green community. The evolution of Planning Theory and Practice*, ed. Z. Tang, Nova Science Publishing, Inc., New York 2010, p. 23.

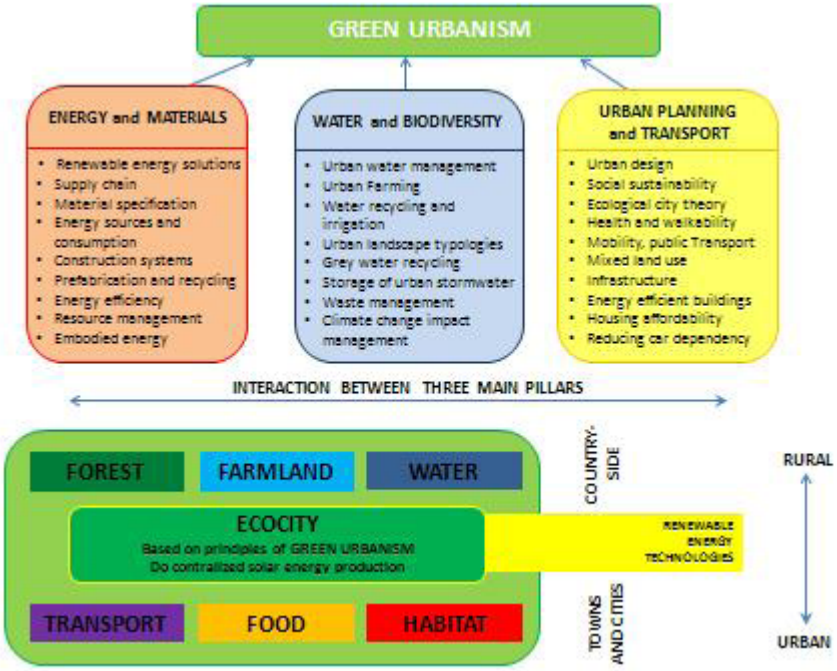
108 http://sapiens.revues.org/1057, access 15.04.2014.

109 http://en.wikipedia.org/wiki/Green_urbanism, access 15.04.2014.

110 T. Beatley, *Green Urbanism: Learning from European Cities*, Island Press. Washington, D.C 2000, p. 78.

Large contributions to the idea of green urbanism brought studies conducted by Lehmann, which let him identify 15 strategic principles of green urbanism.[111],[112] Particular sustainability strategies are needed for cities in developing countries, such as, train local people to empower communities, creating new jobs and diversifying new job structures to harmonize the impacts of rapid urbanisation and globalisation.

Figure 3.7. 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)



Source: S. Lehmann, *Green Urbanism: Formulating a Series of Holistic Principles*, *S.A.P.I.E.N.S*, online since 09 September 2010, connection on 15 April 2014, http://sapiens.revues.org/docannexe/image/1057/img-1.jpg.

[111] S. Lehmann, *The principles of Green Urbanism. Transforming the City for Sustainability*, Earthscan London 2010, p. 85-86.

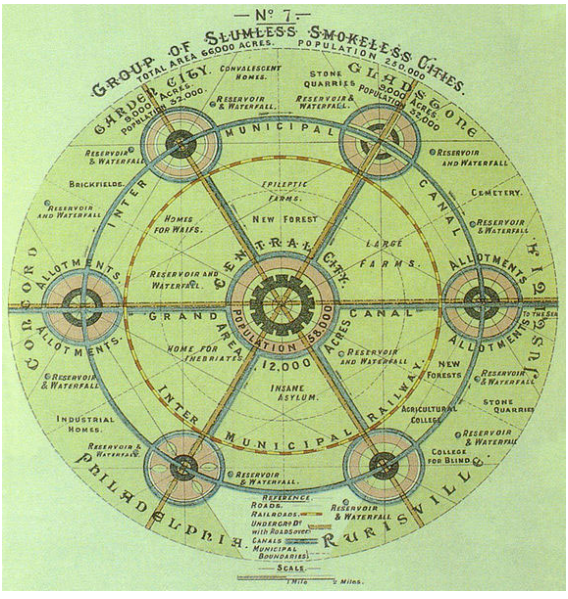
[112] S. Lehmann, *Green Urbanism: Formulating a Series of Holistic Principles*, ***S.A.P.I.E.N.S***, online since 09 September 2010, connection on 15 April 2014, http://sapiens.revues.org/1057.

3.5. Garden City movement

Term Garden City was coined by a British town planner Ebenezer Howard and described in his book *Garden Cities of To-Morrow*[113]. The garden city is an idea which proclaims that it is possible to improve the quality of urban life through the creation of a series of small, planned cities that would combine the amenities of urban life with the ready access to nature typical of rural environments. According to Howard, garden cities can help to solve problems of rural depopulation and the runaway growth of great towns and cities. The main features of Howard's scheme were[114]:

1. the purchase of a large area of agricultural land within a ring fence;
2. the planning of a compact town surrounded by a wide rural belt;
3. the accommodation of residents, industry, and agriculture within the town
4. the limitation of the extent of the town and prevention of encroachment upon the rural belt;
5. the natural rise in land values to be used for the town's own general welfare.

Figure 3.8. Garden City concept by Howard

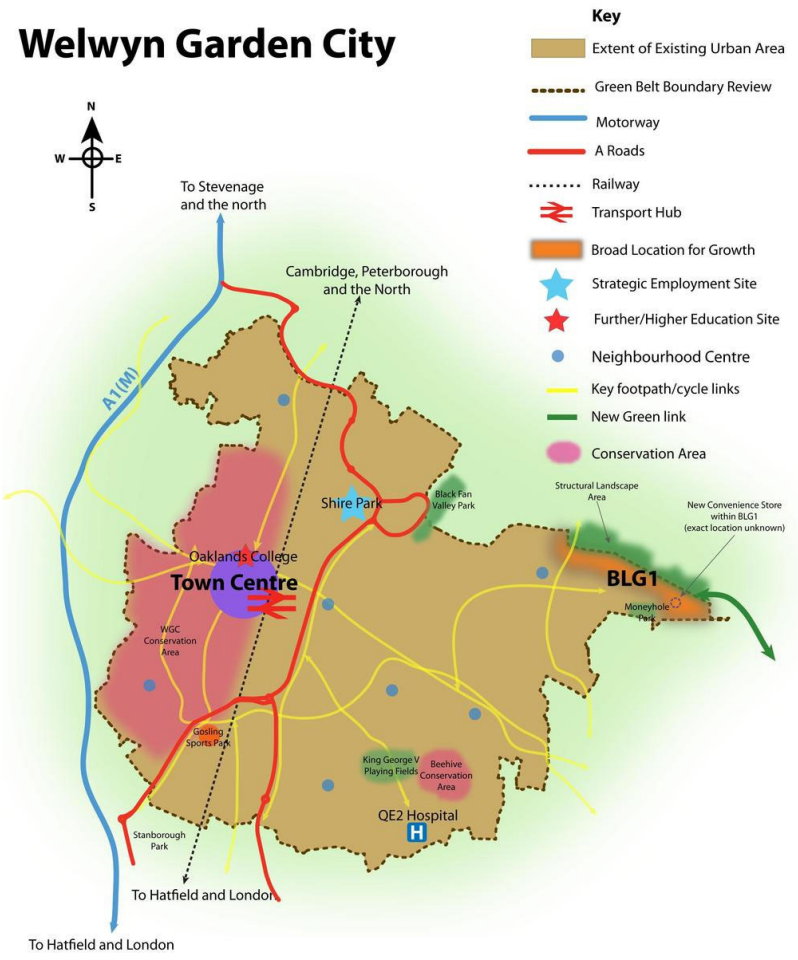


Source: http://upload.wikimedia.org/wikipedia/commons/thumb/3/3d/Garden_City_Concept_by_Howard.jpg/575px-Garden_City_Concept_by_Howard.jpg, access 27.04.2014.

[113] E. Howard, *Garden Cities of To-Morrow*, London 1902.

[114] garden city, *Encyclopedia Britannica Online*. Retrieved 27 April, 2014, from http://www.britannica.com/EBchecked/topic/225784/garden-city.

Figure 3.9. The Welvyn Garden City



Source: http://consult.welhat.gov.uk/events/17414/images/web/2327428_0_1.jpg

Regarding the Howard's ideal a garden city would be located on a 6,000-acre tract of land currently used for agriculture purposes only. At the centre of the city would lay a garden ringed with the civic and cultural complex including the city hall, a concert hall, museum, theatre, library, and hospital. This central part of the city should consist of a combination of a shopping centre, residential area, and then, at the outer edge, industry. The traffic should move along six broad main avenues which radiate from the city centre and another extending the radii and concentric boulevards. The city land would be privately owned by a small group of individuals which as co-owners, should have control of land

use. City revenues should be earned as rents and will constitute the primary fund for the pay mortgages and city services. One of the assumptions about the residents of the town was that low and upper class citizens would find suitable housing fairly close to each other. Only a fraction of the tract's land would be built upon by the town's 30,000 inhabitants; the rest would be used for agricultural and recreational purposes. Howard's garden city idea was realized for his still life. In 1903 a garden city called Letchworth was developed about 30 miles north of London in Hertfordshire, Eng. The success of Letchworth city encouraged the construction of a second one and in 1920 Welwyn Garden City, was established nearby.

Howard's ideas were accepted also by the U.S. government through approving by President Roosevelt a re-packaged version of the garden cities idea as part of the New Deal. Major achievements to this achievement put Dr. Tugwel, head of the Suburban Resettlement Division of the federal Resettlement Administration. He called the American version "greenbelt" cities. Examples of these cities include Greenhills, Ohio; Greenbelt, Maryland; and Greendale, Wisconsin were all part of the greenbelt of new suburbs in the states.[115]

Howard's idea of interrelating country and city in a planned city of predetermined size has gained widespread acclaim and today is widely used in the processes of suburban and city planning as well. The idea of a garden city had also very strong contribution to the creation and development of the eco-city idea.

3.6. Carrot City

Carrot City is a new initiative oriented on possibilities to design cities, urban landscapes, buildings, and gardens in the way which can facilitate the production of food in the city. It is a set of ideas, both conceptual and realized, promoting sustainable food production and reintroducing of urban agriculture within city boundaries. In the actions and the works undertaken in frames of Carrot City are involved design professionals, artists and students, conceiving architecture, urban design, landscape architecture, industrial design, sculpture, and urban planning projects. These initiatives can help to "explore the role that design professionals can play in strengthening the links between urban environments and food, and the relationships between designing sustainably and enabling the

[115] A. Sowder, *Garden Cities. Fully Functioning Communities, Known As Greenbelt Cities in the U.S.*, http://geography.about.com/od/urbaneconomicgeography/a/gardencities.htm, access 27.04.2014.

production and supply of food from local sources."[116] Supporters of the idea of Carrot City want to persuade local communities that the production of food can lead to visually striking and artistically interesting solutions that create community and provide residents with immediate access to fresh, healthful ingredients. The authors of the book *Carrot City: Creating Places for Urban Agriculture* try to show how city planning and architecture that considers food production as a fundamental requirement of design results in more community gardens, greenhouses tucked under raised highways, edible landscapes in front yards in place of resource-devouring lawns, walls that bring greenery into dense city blocks, and productive green roofs. They view urban agriculture as response to the contemporary, global health problems rather than exercise in imagination.[117] The best examples of current *Carrot City* design, presents strategies for re-introducing urban agriculture to our cities.[118] Food production, processing and consumption together is one of the most basic aspects of resilience for human communities and represent a new area of city planning processes. Redesigning the buildings and spaces within the city poses huge challenges to the designers and their new proposals for the future "productive" (and more resilient) city. Designers will search for new solutions in designing buildings and towns enabling the production of food in the city as an important element of food systems as well as the impact that agricultural issues have on sustainable patterns of living. They should be focused on how to increase interest of local communities in growing food within the city and supplying food locally.

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Chapter 4

The transformation of the city towards sustainability

Stanisław Łobejko

4.1. Space-economic approach and criteria

Planning contemporary cities according to the principle of sustainable development is a major challenge. The transformation of the city into a sustainable city needs a space-economic approach.

The space-economic approach is based on three criteria[119]:

- In is proximity, it is based on the criteria of distance.
- In its compactness, it is based on the criteria of density.
- In its adaptability, it is based on the criteria of functional, social and cultural mix.

Sustainable urban planning and design deals with economizing space in the city which is built with respect to[120]:

1. *A city of proximity*. The city of proximity is the city of short distances. Working places in all activity sectors, including commerce, are located close to the town centre(s) and linked by public transport. Thus, the distances between the different urban areas are reduced and can be optimized.
2. *A city of compactness with optimal urban densities*. The city of compactness is the city of high densities. While maintaining its buildings as low as

[119] B. Pachtold, *The Space-Economic Transformation of the City: Towards Sustainability*, Springer Science+Business Media, Dordrecht 2013, p. 3.

[120] Ibidem, p. 3.

possible, in reference to the urban concept "low rise-high density", it integrates all urban amenities, including green spaces of high quality.

3. *A city of adaptability, due to its functional, social and cultural mix open to changing needs*. The city of adaptability is the city of optimal mix. It is the city that evolves continuously to changing economic and social needs. This capacity largely depends on its urban structure that may be of rigid monotony or, on the contrary, integrate functional, social and cultural mix, thus becoming easily adaptable.

Economy of city space benefits in saving materials for construction, labour and energy, increasing productivity and reducing costs and pollution. As a result, life in the city becomes easier, more economical and more convenient for its residents. In planning the city we have to think about space economy and time economy simultaneously because they are closely related to each other. Policymakers should consider their decisions and actions in relation to both space economy and time economy. In practice implementation of a space-economic approach can be done in form of a step-by-step bottom-up strategy assuming three space-economic concepts[121]:

- Reduce the distance by reference to the economic concept of the minimum frontage.
- Increase the density by reference to the geographical concept of the urban land pattern.
- Optimize the mix by reference to the historical concept of the open form.
- Thereafter these three space-economic concepts are integrated in the top-down strategy, focused on:
- Tracing of mobility for traffic and travel activities, promoting walking and cycling
- Building clusters of flexibility for localized activities, adaptable to changing needs.
- Treating areas of accessibility as transition, exchange and interaction between the two.

"In such an approach the core idea of this mixed bottom-up and top-down methodology is threefold. Time and space linearity of economic processes are combined in the territory to create chronological, two-dimensional networks that irrigate and revitalize the city in the three-dimensional space reality of its history."[122]

[121] Ibidem, p. 1.

[122] Ibidem, p. 3.

The space-economic criteria can be measured in three territorial levels: the land plot, the district and the metropolitan area. The distance at the level of the land plot is first measured on the frontage of the land plots along the street and is relevant to the buildings. The distance may be measured in form **of** continuity of buildings on adjacent land plots or discontinuity enabling a certain minimum distance between the neighbouring buildings. For the sustainable city continuity of buildings is preferable, because **it** helps to achieve higher densities. There are two main urban concepts of the minimum frontage:

- first, mixed development assuming construction of different types of buildings: high rise buildings, four storey balcony access buildings and single 2-3 storey family homes, and
- second, low rise/high density assuming construction **of** buildings up to six floors (high-rise buildings being considered socially unacceptable.

The distance at the level of the district with its specific street patterns shows the distance that is relevant for walking distances. The distance at the level of the metropolitan area refers to the transport and traffic system.

Very important measure in the city planning is density, measured at different spatial scales within the agglomeration. Density of the city can be expressed in terms of the number of inhabitants and/or employees per sq. km. There are three basic forms of density measurement[123]:

- The population density at the level of metropolitan area (m^2).
- The building density at the level of the district with its specific street patterns (m^2).
- The building density at the level of the land plots (m^3).

In urban planning land allocation, measured by two indicators[124] plays an important role:

1. *Ratio of urban land allocation*. It quantifies the ratio of private land plots with its density potential (general floor area) to public spaces. It gives an indication on the adequacy of taxes paid by owners of private land to finance the construction and maintenance of the services linked to the public space.
2. *Ratio of public space allocation*. It qualifies the public space by the ratio of the areas for streets to the areas reserved for typical urban activities, the areas of urbanity, like exchange, communication, interaction, leisure and strolling: in short, mainly nonmarket activities that characterize urban behaviour.

[123] Ibidem, p. 5.

[124] Ibidem, p. 8.

Tithe quality and quantity of surfaces consuming energy, referred to the envelopes of the buildings and material used to their construction (needs of insulation) and the sealed surfaces, mainly streets and parking spaces are important issues in the construction of a sustainable city. The reduction of these surfaces usually leads to the reduced consumption of energy, materials and also lower emission of greenhouse gases. The transformation city towards sustainability requires consequently application and systematic optimization of seven indicators[125]:

- Three space-economic criteria: distance, density, mix.
- Two ratios of urban land allocation.
- Two energy surfaces.

The transformation of the city toward sustainability is implemented on two stages. At the first stage the bottom-up approach is applied, starting from the land plot to the metropolitan area in order to reduce the distance, increase the density, and optimize the mix of both. At the second stage the top-down approach is applied, beginning from the metropolitan area level and ending on the land plot area. Its purpose is to optimize the public space regarding the two urban land-allocation ratios. The three main space-economic concepts are originated in history of European design and construction practices[126]:

- The first, the economic concept of the minimum frontage, is mainly of English origin.
- The second, the geographic concept of the land pattern, is mainly of French origin.
- The third, the historic concept of the open form, can be considered being of Italian origin.

4.2. Urban land patterns

The geographical concept of the urban land pattern is derived from the concept of the rural land pattern, began first in France. "The analysis of the rural land pattern considers the landscape as both a system of analysing the existing context and a structure for integrating new development."[127] The concept of the urban land pattern is similar to the rural land pattern. In its assumptions is a synthesis of the topological, hydrological and biological features of the area,

[125] Ibidem, p. 11.
[126] Ibidem, p. 15.
[127] Ibidem, p. 23.

the existing way and street systems, the urban and agricultural land parcels and existing artefacts. As a result of this process virtual urban structures arise which are determined by geographical, historical and economic conditions, related to human activities on this area. Next the urban land grid should be prepared, based on economic concept of minimum frontage and urban street pattern appear. At the end of the planning process a master plan and district plan of new settlement should be prepared. Of course there are many other ways to realize the combined approach of the economic and geographical concepts. Today the development of a city towards the sustainability faces two problems to be solved[128]:

1. The requirement for the healthy environment with enough sun and air has to be solved in reaching optimum densities with low-rise buildings.
2. The necessity of lowering costs and prices has to be aimed by efficient management and coordination, assuming the integration of all actors of design, build and property management.

Planning the sustainable city is a difficult challenge. "The proposed bottom-up approach should be completed by a top-down strategy. This means that the approach of the city as a built product has to be integrated in the approach of the city as process of permanent transformation towards sustainability."[129] The experience gained through full implementation of the economic concept of the minimum frontage up to 1970s caused changes in past urban concept of mixed development and emerging of new concept of high density low-rise. This new urban concept opened the way to transform the city towards sustainability. In addition to this new way, two other conditions should be taken into account. The first one refers to the growing need to take into consideration the growing awareness of the necessity to preserve natural, biological and historical conditions. While the second condition refers to the possibility of full implementation of the economic, geographical and historical concepts in the urban open form.

[128] Ibidem, p. 45.

[129] Ibidem, p. 45.

4.3. Planning sustainable city

City planners work to ensure the sustainable development of the city, **its** growth and future prosperity, including[130]:

- **Places where people can live**
  Planners estimate the number of households that will need to be housed in the coming years and recommend where within the community land should be set aside for homes to be built. In the process, planners work with communities to determine the proportion of homes that will be single-family houses, duplexes, or multi-family housing and the proportion that will be targeted for home ownership versus rental. Planners also work on policies affecting the price of housing in a community, to ensure that low-income and moderate-income residents (like store clerks, restaurant staff, nursing assistants, and teachers) have comfortable and affordable housing available to them.
- **Places where employers can build shops, offices, and factories**
  In addition to working to identify the best places within a community for locating factories, shopping areas, and offices, planners also work to attract jobs to communities. Economic development planners study the local economy to identify needs and create programs to fill those needs. For example, planners work with employers and local educational institutions to make sure that the students receive training in the skills required by local industries or by the industries that the community would like to locate there.
- **Transportation facilities (roads, rail, airports, and seaports)**
  Planners study transportation systems to determine when additional transportation facilities are needed, where they should be built, and the mix of transportation options that should be available. Planners collect and analyse information to find out whether the growth and prosperity of a region is hampered because the transportation network does not provide sufficient access to some locations in the community or because congestion is creating excessive delays in getting from one place to another. Planners know that industry needs an efficient transportation system for moving raw materials in and manufactured products out. While the number of cars per person has steadily increased since the nineteenth century, planners work to create a balanced transportation

[130] *Becoming an Urban Planner: What Planners Do*, www.planning.org/ncpm/pdf/UrbanPlannerExcerpt.pdf, access 30.04.2014.

system in which residents can choose to live in areas that are designed to make biking, walking, and transit (buses, light rail, and commuter rail) more successful.

- **Clean water for drinking and washing and systems for managing wastes**
  Planners work with civil engineers to ensure that basic urban infrastructure – sewer and water – will be available as a community grows. How a community grows can have a dramatic effect on the cost of providing sewer and water services. For example, laying out a neighbourhood with large lots served by sewer and water requires more spending on pipes and requires more maintenance by the city in the future. Planners work with communities to understand the effects of land use decisions on the cost of providing sewer and water services and to modify land use policies as needed. Planners also work with hydro geologists and civil engineers to develop plans for the sustainable use of sources of drinking water, to ensure that the supply of water will remain sufficient in the future.

- **Places where people can recreate/entertain**
  Planning for parks, open space, and community facilities like ice rinks, athletic fields, and community centres is important to any community. Planners study the age distribution of the population as it is today and as it will be in the future. A city with a growing number of school-age children requires a different mix of recreation facilities than a city with an aging population entering retirement. Planners seek a fair distribution of parks and open space across the community.

- **Places where people want to be**
  Planners know that it is not enough simply to meet basic needs for housing, shopping, working, and recreation. People choose where to live, work, and play based on many factors, and the physical design of urban places is one of those factors. Urban design considerations – how tall should our buildings be, how far should they be set back from the street, where parking for cars and bikes should be located – are an important aspect of the urban planning puzzle. Decisions and rules regarding the physical design of the community determine the appearance and character of the place and can either attract or repel people and investment in the community.

- **Community development**
  Most planners working on community development work in areas with high levels of poverty and low levels of education, employment, and

income, whether in central city neighbourhoods, suburbs, or rural areas. They provide assistance to small businesses, bring resources to the community for improving the quality of affordable housing, and develop programs for increasing the skills and job readiness of residents.

- **Supplies of energy.**
  Planners have always worked with energy utilities to predict future energy demands and to locate sites for new energy facilities, such as power plants, natural gas pipelines, or petroleum storage areas. Today, increasingly, planners are at the forefront of identifying ways in which communities can reduce their energy needs and plan for the future of renewable energy resources.

We have to understand that sustainable should be both production and consumption in context of using natural resources and growing public awareness in recycling, reduction and reuse of materials. Conscious consumers expect that production technologies will be cleaner and less polluting the natural environment. The sustainable methods of production would use much fewer resources and generate close to zero waste.[131] But important are also future strategies of sustainable consumption promoting a new lifestyle while ensuring high quality of life. Analysing this issue from the point of view a high developed society Newman and Jennings have proposed four main sustainable consumption strategies[132]:

1. *Voluntary simplicity strategy*
   Disapproving consumerism and viewing overconsumption as an illness in society, this strategy aims to assist people to find alternative ways to satisfy their needs and promote simple ways of living.

2. *Demand management strategy*
   Education is sought to educate consumers the ways in which to meet their needs without consuming much non-renewable resources. The promise is however that reducing resource use should not mean lowering quality of life. Application of this strategy needs to be adopted at both household and corporate levels, in order to achieve a meaningful reduction as a consequence.

3. *Sustainable procurement strategy*
   Government and institutions, together with households should adopt purchasing programmes using the notion of sustainability. This

[131] P. Newman, I. Jennings, *Cities and sustainable ecosystems*, Island Press, Washington DC 2008, p. 188-189.

[132] Ibidem, p. 191-198.

sustainable shopping behaviour should build up more sustainable markets by consuming less. More attention should be directed towards more environmentally sound products.

4. "*Slow movement" strategy*
   "Slow food", "slow cities" and "slow traffic" are three elements of the "slow movement" strategy that are anticipated to help cut down consumption. "Slow food" is to counteract fast food and fast life in an attempt to rediscover the real taste of authentic and local/regional food sources and quality pace of life. "Slow cities" place emphasis on small towns and cities, with preference modelled after the European late medieval and renaissance era. "Slow traffic" calls for traffic calming in favour of small road capacity emphasizing walking, cycling and transit.

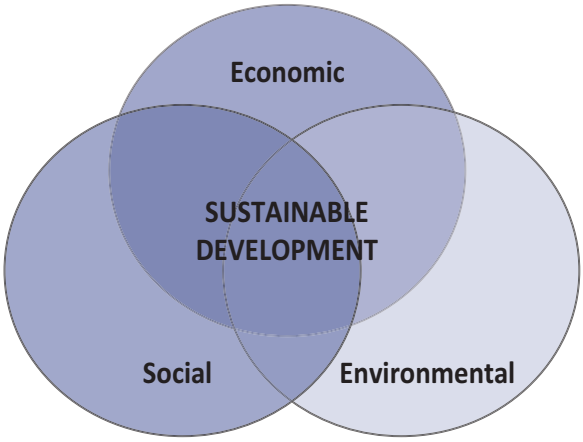
4.4. Triple Bottom Line Model

Coined by the author John Elkington in 1994 and later expanded in his book "*Cannibals with Forks: the Triple Bottom Line of 21st Century Business*", the term "*Triple Bottom Line*" points on the need to maintain a balance between environmental, social, and economic sustainability for organizations. This term has largely been popularized in the corporate world as an accounting method to quantify a company's responsibility to not just its "shareholders" but its "stakeholders" as well. The term "stakeholders" refers to anyone who is influenced, either directly or indirectly, by the actions of the firm. The stakeholder theory assumes that, the business entity should coordinate stakeholder's interests, instead of maximizing shareholder's (owner's) profit.

Nowadays many firms adopting Triple Bottom Line principles as part of a campaign to mitigate their environmental and community footprint while ensuring a positive bottom line. The Triple Bottom Line concept was adapted for Shell by Sustain Ability (a consulting firm) and described more succinctly for the corporate world as "People, Planet and Profit".

"People" (Human Capital) pertains to fair and beneficial business practices toward labour, the community and region in which a corporation conducts its business. A Triple Bottom Line company conceives a reciprocal social structure in which the well-being of corporate, labour and other stakeholders' interests are interdependent. A triple bottom line enterprise seeks to benefit many constituencies, not exploiting or endangering any group of them.

Figure 4.1. Triple Bottom Line model of sustainable development



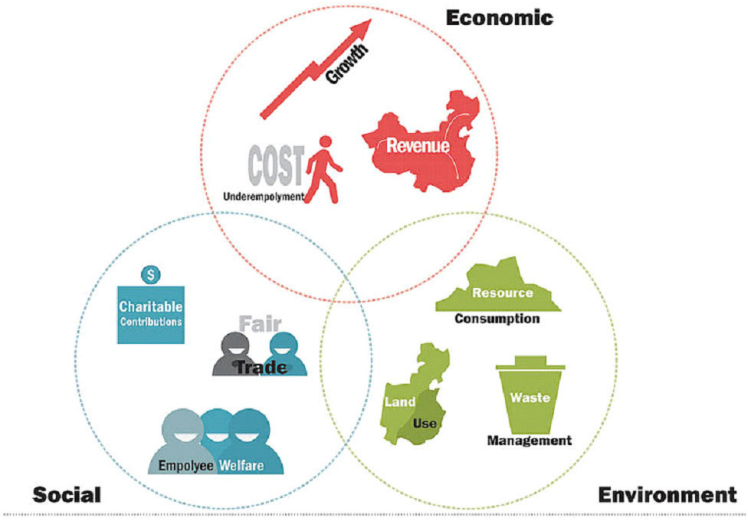
Source: Southwestern Commission's Regional Toolbox. A Pilot of the Mountain Landscapes Initiative, Southwestern Planning and Economic Development Commission, the Community Foundation of Western North Carolina and The Lawrence Group Architects of North Carolina, 2009, http://www.regiona.org/wp-content/uploads/2011/06/Toolbox-Complete.pdf, p. 23, access 21.04.2014.

"Planet" (Natural Capital) refers to sustainable environmental practices. A Triple Bottom Line company endeavours to benefit the natural order as much as possible or at least do no harm and curtail environmental impact. A TBL endeavour reduces its ecological footprint by, among other things, carefully managing its consumption of energy and non-renewables and reducing manufacturing waste as well as rendering waste less toxic before disposing of it in a safe and legal manner.

"Profit" is the bottom line shared by all commerce, conscientious or not. In the original concept, within a sustainability framework, the "profit" aspect needs to be seen as the economic benefit enjoyed by the host society. It is the lasting economic impact the organization has on its economic environment. This is often confused to be limited to the internal profit made by a company or organization. Therefore, a Triple Bottom Line approach cannot be interpreted as traditional corporate accounting plus social and environmental impact.[133]

[133] *Southwestern Commission's Regional Toolbox. A Pilot of the Mountain Landscapes Initiative*, Southwestern Planning and Economic Development Commission, the Community Foundation of Western North Carolina and The Lawrence Group Architects of North Carolina, 2009, http://www.regiona.org/wp-content/uploads/2011/06/Toolbox-Complete.pdf, p. 23, access 21.04.2014

Figure 4.2. The areas of study that the Triple Bottom Line model works with



Source: http://upload.wikimedia.org/wikipedia/commons/2/2a/Triple Bottom Linegraphic.jpg, 21.04.2014.

4.5. The top-down strategy

The bottom-up approach should be a part of the top-down strategy. At first three space-economic criteria and the three concepts were used in linear form. Later this linear process took the form of a continuous loop of distance, density and the mix of both. "Based on the economic process of the minimum frontage at the level of the building cluster, and its land parcel, the whole design process is becoming nothing else than additions and combinations of these building clusters to form the neighbourhood, the district and the city".[134] These findings should be integrated in top-down strategy with the steady evolution of social practices directed on city proximity, compactness and adaptability. All of these actions begin in the bottom-up process "but their full impact can only be reached by their integration in the top-down strategy with the ultimate goal of reaching the city of adaptability. In the planning of a sustainable city mobility and formation of connected urban networks are very important. These urban mobility networks are similar to all other similar infrastructure networks supplying to the buildings water, electricity, gas. According to the space-economic requirements mobility networks are higher density in urban areas

[134] B. Pachtold, *The Space-Economic Transformation of the City: Towards Sustainability*, Springer Science+Business Media, Dordrecht 2013, p. 47.

than in suburban. Historically urban networks were mostly centralized, because that way they let supply all buildings in best way from space-economic point of view. In the middle of the 20th century the same approach has been applied to the transportation network. But now this approach seems to have still increasing operating costs. Currently we observe very fast development of technology which strongly influences the possibility of constructing a new form of urban transport and supply networks. The economic and technological changes are creating entirely new opportunities[135]:

- Diversified and personified sources of energy.
- Integrated management of the water resources up to waste treatment.
- Developed networked services adaptable to changing needs are some of the new social, environmental and economic characteristics that enable the development of flexible, diversified and combined system.

Building the city towards sustainability required a heuristic approach to the planning process combining many different city characteristics and allowing for optimization of urban networks and ecosystems. Urban strategy for planning of the street system should be based on three principles[136]:

- First, the transit roads serving mainly as traces of mobility.
- Second, the main street linking the city centre to the districts with their neighbourhoods and buildings clusters of flexibility.
- Third, the access street or footpaths determining the areas of accessibility to the land.

This threefold spatial approach allows **to** integrate the street network with water network and establish the physical connection between the urban networks and the urban ecosystems[137]:

- Natural flows of rainwater reach the drainage system at all other scales up to main river; crest lines and valleys guide the paths and structure road systems.
- In urban eco-areas, these natural flows of rainwater reaching drainage system are combined with the urban street networks.
- Buildings in neighbourhoods as part of these urban eco-areas crossed by all these natural and technical networks are the achievement of the green city, first in being energy efficient.

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135 S. Moffatt, *City Green: a guide to the green infrastructure for Canadian Municipality*. Federation of Canadian Municipalities (ed), Vancouver 2001.

136 B. Pachtold, *The Space-Economic Transformation of the City: Towards Sustainability*, Springer Science+Business Media, Dordrecht 2013, p. 51.

137 Ibidem, p. 51.

This approach to the eco-city planning results in combining of three networks: the grey networks of streets, the green networks of vegetation and the blue network of water. In addition to the integration of urban networks an important element of sustainable eco-city planning are the building clusters of flexibility, located in continuity along with traces of mobility. The building clusters of flexibility are planned as a combination of different types of buildings, connected to the open area and the public space. "Building clusters are the biggest repetitive-built elements of the urban structure on a regular piece of land, delimitated by the front street perpendicular to it bordered by neighbour land parcels (partly walls) or side streets (2 and 3) and by the backstreet or open land."[138]

Because the building clusters of flexibility are developed in reference to the economic concept of the minimum frontage, thereby they are optimal to distance and density. But we have to remember that flexibility cannot be only considered from technical **point of view**. Flexibility should be understood in connection with three main criteria: social, cultural and functional joining both previous ones. Flexibility allows easy replacement of housing in order to adapt its size to the real needs in case of changing family size, etc., or needs to move to another area when changing jobs**.** It should give a possibility to find an apartment corresponding to the social status and needs in the field of culture. In vertical stack building flexibility lets easy conversion of an apartment into an office and vice versa. Inside the apartment flexibility means that it is possible to move walls to make some rooms and to change installed equipment. Building clusters through their connection to the public space, are also an important element of the urban structure and they should be compatible with space-economic standards allowing for privacy as well as for commercial and public activity of city inhabitants. To meet these requirements the commercial area can be located on lower floors whereas housing and offices area on upper floors.

Reaching the main objectives of planning process towards sustainable development of the city needs existence of urban policy oriented on integration areas of accessibility in a dense urban structure. The building of clusters of flexibility areas improves quality of urban exchange, communication and interaction. Their location should respond to the time of mobility regarding the moments of stopping, staying, talking and acting together and also to the whole urban network of activities including such spaces as relaxation areas, playgrounds and sport facilities. In the way of transformation of the city towards sustainability the urban structures can be developed to reach new social needs

[138] Ibidem, p. 52.

of public spaces. Actions taken in optimization of transformation process of the city towards sustainability should be measured at two levels:

- The optimization of the two indicators of urban land allocation:
  - The ratio of private land plots to the public space.
  - The ratio of streets to the areas reserved for typical urban activities.
- The reduction of the energy surfaces.
  - The insulated surface of the buildings
  - The reduction of sealed surfaces of streets and squares.

The bottom-up approach based on space-economic concepts and criteria helps to identify actions needed to improve the city in economic, geographical and historical terms. The top-down urban strategy based on ratios and indicators showing progress on the optimization city planning processes closes whole, making the city better organized and friendly to its inhabitants.

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Chapter 5

Planning in eco-city

Stanisław Łobejko

5.1. Idea of city planning

The word 'planning' is used in many areas of life. It can be used for example as retirement planning, wedding planning, and health system planning, and many others. In each of these meanings planning is about the future. But city planning is different from the others because of its focus on "place." City planning (also known as: urban and town planning) is a complex process oriented on the use of land and design of the urban development, including transportation and infrastructure network, to ensure properly development of settlements and communities. It requires research and analysis, strategic thinking and planning, architecture and urban design, involvement of local community, implementation and management. Its task is to make responsible decisions before choosing alternative ways of development of the city. "Urban planning focuses on shaping the nature of places, including the built environment (houses, stores, offices, and factories) and the natural environment (fields, forests, waters, and wetlands)."[139]

The dynamic growth of cities and a steadily increasing number of their inhabitants cause that planning of cities is becoming a big challenge for local communities. Planning is especially important for the development of eco-cities, which cannot occur as a result of accidental actions, but as a result of a planned, well thought development policy. Therefore, it is important to understand what is meant by the concept of city planning. In general "Planning is an active process

[139] *Becoming an Urban Planner: What Planners Do*, www.planning.org/ncpm/pdf/UrbanPlannerExcerpt.pdf, access 30.04.2014.

requiring careful thought about what could or should happen in the future and involves the coordination of all relevant activities for the purpose of achieving specified goals and objectives."[140] In the literature one can find many different definitions of city (urban) planning. Regarding N. Taylor urban planning (urban, city, and town planning), it is a technical and political process concerned with the use of land and design of the urban environment, including transportation networks, to guide and ensure the orderly development of settlements and communities. It concerns itself with research and analysis, strategic thinking, architecture, urban design, public consultation, policy recommendations, implementation and management.[141] The American Planning Association defines city planning as follows: "Planning, also called urban planning or city and regional planning, is a dynamic profession that works to improve the welfare of people and their communities by creating more convenient, equitable, healthful, efficient, and attractive places for present and future generations."[142] As we can see urban planning is directed on improving the welfare of its current residents but also for future generations. In process of city planning all inhabitants, their leaders, local government, businesses and institution should be involved. Envisaging the future of a city is a difficult task, but without it, planning of the city development would not be beneficial for people. Good planning can help to build cities of tomorrow in which people will have better conditions for living and working, and also to preserve the right balance of new development and essential services, environmental protection, and innovative change. Planning is done in many arenas and requires planners who are well-educated and with different specializations. Planners work with local authorities as well as urban residents by helping them to envisage the development of the future city, showing them new possibilities and solutions to current and future community problems as well as help communities meet the challenges of growth and change. In many countries there are official associations linking a wide range of planners and the people and organizations who want to cooperate. In the USA such a role is filled by the American Planning Association and its professional institute, the AICP (American Institute of Certified Planners), help planners, officials, and citizens better serve their communities by providing research, educational resources, practical advice and tools, and up-to-date information on planning. The regional planning, is defined as a process dealing with the efficient placement of land-use activities, infrastructure, and settlement growth across a larger area of land than an individual city or town. The related field of urban planning deals with the specific issues of city planning. Both the

[140] http://www.fao.org/docrep/w8212e/w8212e07.htm, access 21.04.2014.

[141] N. Taylor, *Urban Planning Theory since 1945*, Sage, London 2007.

[142] American Planning Association, https://www.planning.org/aboutplanning/whatisplanning.htm, access 21.04.2014.

urban (city) planning and regional planning are encapsulated in spatial planning, meaning the methods used by the public sector to influence the distribution of people and activities in spaces of various scales covering such disciplines as: land use, urban, regional, transport and environmental planning as well as economic and community planning. Spatial planning is accomplished on local, regional, national and inter-national levels and often result in the creation of a spatial plan. In publications we can find numerous definitions of spatial planning. One of the earliest definitions comes from the European Regional/ Spatial Planning Charter (often called the 'Torremolinos Charter'), adopted in 1983 by the European Conference of Ministers responsible for Regional Planning (CEMAT): "Regional/spatial planning gives geographical expression to the economic, social, cultural and ecological policies of society. It is at the same time a scientific discipline, an administrative technique and a policy developed as an interdisciplinary and comprehensive approach directed towards a balanced regional development and the physical organization of space according to an overall strategy."[143] In its European dimension regional/spatial planning contributes to a better spatial organization in Europe and to the finding of solutions for problems which go beyond the national framework and thus aims to create a feeling of common identity, having regard to North/South and East/ West relations.

In the central concern of regional/spatial planning is a human being and his/ her well-being as well as his/her interaction with the environment regarding his/her individual quality of life conducive to the development of his/her personality in surroundings planned on a human scale. Regional/spatial planning must take into consideration the existence of a multitude of individual and institutional decision-makers influencing the organization of space and not forgetting about the uncertainty of the future, the market pressures, the special features of administrative systems and the differing socio-economic and environmental conditions.

City planning can be described in a number of different ways, like for example[144]:

1. It is a process concerned with the use of land and design of the urban environment.
2. It deals with the planning and architectural styles of different regions and countries.

[143] European regional/spatial planning Chapter, Torremolinos Chapter, http://www.coe.int/t/dgap/localdemocracy/cemat/VersionCharte/Charte_bil.pdf, access 21.04.2014.

[144] *Five definitions of urban and regional planning*, http://wiki.answers.com, access 14.05.2014.

3. It is a study that guide and ensure the orderly development of settlements and communities.
4. It is a study that integrates land use planning and transportation planning to improve the built, economic and social environment of communities.
5. It is a study that deals with the planning of the architectural layout of different communities and regions.

The city planning performs many different functions, the most important of which are[145]:

1. improving efficiency of land use,
2. balancing public and private interests,
3. providing a wide range of choices, and
4. promoting public participation in decision making.

The concept of eco-city planning is different from traditional planning models. The difference lies in the emphasis on ecological principles in the designing process. An eco-city and green community model planning help local communities understand how to improve the quality of life of their inhabitants. The implementation of eco-city planning allows to plan sustainable city functioning as "interconnected system which includes land demands, land use types, urban growth boundaries, open spaces, and density"[146]. Transport and energy systems as well as socioeconomic context of local community, human and economic activity are very important for the eco-city planning process.

At the beginning of the 20th century city planning takes the form of institutionalized activities undertaken by many cities, which moved into professional planning. In this time, efforts are being made in order to standardization, professionalization and recognition of planning as part of regional planning and national. In the first half of the 20th century many cities began to conduct regular activities in the field of urban planning, made significant progress in this subject. While in the initial period prevailed physical planning after World War II, under the influence of welfare capitalism more emphasis was placed on social issues and reducing of social inequality and poverty. City planning begins to be in field of the interest of both politicians and non-governmental organizations, local and regional authorities and is increasingly dependent on the political and economic decisions. In effect of these and other positive factors began a period of modern urban planning with

[145] Z. Tang, T. Wei, *The history and evolution of eco-city and green community*, in: *Eco-city and green community. The evolution of Planning Theory and Practice*, ed. Z. Tang, Nova Science Publishing, Inc., New York 2010, p.12.

[146] *Eco-city and green community. The evolution of Planning Theory and Practice*, ed. Z. Tang, Nova Science Publishing, Inc., New York 2010, p. 5-6.

a steady increase in public participation in planning decisions based on the bottom-up planning model. Modern city planning process becomes more rational in their nature, and is called as a rational planning theory.

The alternative type of planning theory which emerged in 1960s was called as incremental planning theory. It assumes that the planning process is incremental, disjointed, dynamic, and serial. As an opportunity to reformulate traditional rational planning a communication and collaboration theory emerged, assuming increased participation of stakeholders and citizens in the planning process.

Planners have always played an important role in the planning process. A city (urban) planner is a professional who works in the field of urban planning/land use for the purpose of building a better living environment for a local community. He or she should be able to formulate plans for the development and management of urban and suburban areas and analyse land use compatibility as well as economic, environmental and social trends. Developing the plan for local community (whether commercial, residential, agricultural, natural or recreational), urban planners must also consider a wide array of issues such as sustainability, air pollution, traffic congestion, legislation and zoning codes. "The importance of the urban planner is increasing throughout the 21st century, as modern society begins to face issues of increased population growth, climate change and unsustainable development. An urban planner could be considered a green collar profession."[147] The great challenge of contemporary urban planning lies in the fact that it is a profession that simultaneously[148]:

1. uses knowledge rooted in natural sciences – necessary, for example, to plan roads and the physical layout of cities;
2. uses knowledge rooted in social sciences – necessary, for example, to understand the social implications of a new road;
3. aims to provide a contribution on what to do, when to do it, how to do it, and (at last but not the least) why to do it.

Urban planners usually work for developers, private property owners, private planning firms and local/regional governments assisting in the large-scale planning of communal and commercial developments, as well as public facilities and transportation systems in such disciplines as community, cultural, environmental, historic preservation, housing, regional and transportation planning. Planners work to create a vision of the future of their city, buildings,

[147] http://en.wikipedia.org/wiki/Urban_planner, access 30.04.2014.

[148] A. Ferreira, O. Sykes & P. Batey, *Planning Theory or Planning Theories? The Hydra Model and its Implications for Planning Education*, "Journal for Education in the Built Environment", Vol. 4, Issue 2, December 2009.

and streets, land using, housing as well as community development including its economic and demographical situation. Ability to predict the future, creating a vision for the future of the city is an extremely useful feature of a planner. To be able to correctly predict the future planners need to get to know the present. And therefore they have to study current conditions and trends, and collect information about population, the economy, and the environment. Collected and analysed data and information allows planners to understand whether the city is growing in population or shrinking and whether employers are moving into the city and creating new jobs or moving away because of suburbanization or globalization. Planners are trying to find an answer to the question whether the supply of houses is likely to be sufficient to meet the needs of residents over the next 20 years, and whether the existing transportation system allows people to get to jobs, shopping, school, and recreational activities without safety problems, unacceptable delays, and increasing pollution.[149]

The city planners can specialize in breadth of the geographic areas that they work in, as for example[150]:

- Site plans for laying out the buildings, streets, driveways, walkways, and other futures of a proposed development site.
- District and corridor plans for considering issues of access, identity and economic development is a specially designated district or street corridor.
- Neighbourhood plans that consider all the issues in a neighbourhood, including housing, character and needs, job access, transport access, public safety, and many other facets of neighbourhood life and character.
- City wide plans, which can be comprehensive, within the scope of looking in a wide range of issues, similar to a neighbourhood plan, or focusing on single issue, such as city wide park plan, transit plan, or economic development plan.
- State or regional plans, which look at broad geographic area encompassing multiply communities of both urban and rural character. State and regional plans, are likely to focus on a limited number of issues, such as regional water supply plan or state wide energy independence plan.

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149 *Becoming an Urban Planner: What Planners Do*, www.planning.org/ncpm/pdf/UrbanPlannerExcerpt.pdf, access 30.04.2014.

150 M. Bayer, N. Frank, *Becoming an Urban Planner. A Guide to Careers in Planning and Urban Design*, John Wiley & Sons, Hoboken NJ 2010.

5.2. Eco-city design principles

In new conditions of the contemporary world city planning needs change in our current understanding of what constitutes good urban design and planning. The traditional approach to planning focusing on planning cities around automobile transportation, and zoning for single uses, will no longer be for many economic, environmental, and culturally reasons acceptable. Eco City Builders have proposed a new approach to resilient eco-city planning and urban design based on eleven principles[151]:

1. *Density, Diversity and Mix.* Resilient Cities and neighbourhoods will need to embrace density, diversity and mix of uses, users, building types, and public spaces. There is a strong need for maximizing the active use of space and land. A compact city built as a mix of uses (e.g. offices, residences, coffee shops etc.), with sufficient density, and which is accessible to a diversity of users (e.g. children, youth, seniors, high-income, low-income, etc.) is more utilized during long periods of time than low density residential neighbourhood or suburban business parks. Dense mixed use neighbourhoods also allow for the effective functioning of all types of business, social and cultural activities with very low inputs of energy for transportation and logistics.
2. *Pedestrians First*. Resilient cities and neighbourhoods will prioritize walking as the preferred mode of travel, and as a defining component of a healthy quality of life. Reducing car-dependency is a key objective and imperative. Luckily, the alternative modes of transportation – namely walking, cycling, and transit – result in more sustainable urban environments, and in an improved quality of life.
3. *Transit Supportive*. Resilient cities will need to re-orient their way of thinking, by shifting from car oriented urban patterns (e.g. cul-de-sacs and expressways) to transit oriented urban patterns and developments (e.g. mobility hubs, intensified corridors). Not only will pedestrian, and mass transportation friendly planning increase the quality of life **of cities**, as fuel prices rise after Peak Oil, only cities that are viable without heavy dependence on the car will have the best chances of economic and social success.
4. *Place-Making*. All successful cities and successful neighbourhoods include vibrant places, with a strong sense of identity, which are integral to community life and the public realm: parks, plazas, courtyards, civic buildings, public streets, etc. A resilient post-carbon community, which

[151] http://www.resilientcity.org/index.cfm?PAGEPATH=Resilience/Urban_Design_Principles&ID=11928, Access 27.04.2014.

reorients city-life to the pedestrian scale (a 500 m radius), must focus its efforts to create a number of local destinations, which attract a critical-mass of users and activities. Sprawl, for example, has very little place-making. A traditional village or an urban downtown, by contrast, have innumerable nocks and crannies, grand public spaces, gorgeous streetscapes, which make them desirable, successful, and sustainable.

5. *Complete Communities*. Resilient neighbourhoods will provide the needs of daily living, within walking distance (a 500 m radius). To achieve this, destinations must be accessible within a pleasant walking distance – people should be able and willing to walk from home to work, to school, to shop, to recreate/entertain, and to engage the activities of their everyday life. Longer distances should be achievable through transit. Connectivity is central to making an area pedestrian oriented. Streets and pedestrian walkways must be enjoyable to walk, must link key destinations, and must operate at a fine scale.
6. *Integrated Natural Systems*. Resilient cities and neighbourhoods will conserve and enhance the health of natural systems (including climate) and areas of environmental significance, and manage the impacts of climate change. Cities and neighbourhoods need to develop in a way that conserves and enhances the quality of the water flow and supply, likewise for the quality of air and land. Climate is, increasingly, a key driver to transforming our development patterns and living choices. Protecting existing biodiversity, indigenous or endangered species, wetlands, the tree canopy, connectivity, are all a necessary aspect of securing healthy natural systems.
7. *Integrated Technical and Industrial Systems*. Resilient Cities and neighbourhoods will enhance the effectiveness, efficiency and safety of their technical and industrial systems and processes, including their manufacturing, transportation, communications and construction infrastructure and systems to increase their energy efficiency, and reduce their environmental footprint. The strategic integration of industrial and technical systems into mixed use neighbourhoods should be planned so as to produce not only better economic performance, but also to create easily accessible and safe working environments, healthy surrounding neighbourhoods, and no negative impacts on the natural environment.
8. *Local Sources*. Resilient regions, cities, and neighbourhoods will grow and produce the resources they need, in close proximity (200 kilometre radius). The environmental cost of the movement of goods and energy increases every day, and the potential for price increases in transportation fuels as a result of Peak Oil increase the future costs of non-local sources.

Thus, populations must seek to satisfy their consumption needs from local and regional sources.

9. *Engaged Communities*. The development of resilient cities and neighbourhoods will require the active participation of community members, at all scales. Residents and stakeholders must be a part of planning and designing their cities and their communities. They must also be a part of delivering a new vision: by choosing to walk, by engaging each other, by generating awareness, and by demanding higher standards.
10. *Redundant and Durable Life Safety and Critical Infrastructure Systems*. Resilient Cities and neighbourhoods will plan and design for redundancy and durability of their life safety and critical infrastructure systems. Key infrastructure systems such as drinking water supply, electrical power, and residential heating in winter, and key life safety systems, such as police, fire, and emergency response services and their support systems, must be planned and designed for a level of redundancy and durability that will allow them to be durable enough to resist present and future environmental stresses.
11. *Resilient Operations*. Resilient cities and neighbourhoods will develop building types and urban forms with reduced servicing costs, and reduced environmental footprints. Urban sprawl is extremely expensive to service and maintain – the amount of land, roads, pipes, and infrastructure required per capita is disproportionately large. A compact, mixed-use urban environment, by contrast, is far more efficient in its demand for municipal services and infrastructure requirements.

5.3. Types of city planning

There are many different types of city plans, like for example "comprehensive" or "master" plan depending on the community aspects affected and by local government impacted. Sometimes such a type of plan is called a "general" plan. These main plans can be divided in three type sub-plans called: physical plans, economic plans and social plans. In smaller areas these three types of plans are sometimes combined in one plan called a neighbourhood plan. Plans prepared for corridors, commercial districts, industrial areas, downtowns, or redevelopment districts have such character.[152]

[152] N. Thompson, *Good City Planning Gets Results*, http://www.useful-community-development.org/city-planning.html, access 5.05.2014.

The city planning process has always been accomplished in four consecutive steps[153]:

1. Gathering information and data, including maps and statistics.
2. Analysis of existing conditions.
3. Consider city planning alternatives.
4. Decide on the future of your community.

In case of preparing physical plan of local development we should bear in mind the three main topics: land use, transportation, school and open space planning. Land use planning requires information about land use classification combined with land use planning principles. Transportation planning applies to both the planning of highways, roads, streets, and also complete street approach due to the needs of pedestrians, cyclists and transit opportunities. Every local community may be interested in local school size and siting. Open spaces, which can have the form of parks, preserves, conservation areas, or simply undeveloped land are very important

Various types of planning emerged and were developed over the 20th century. Below are the six main typologies of planning, as defined by David Walters in his book, *Designing Communities*[154]:

- *Traditional or comprehensive planning*: Common in the US after WWII, characterized by politically neutral experts with a rational view of the new urban development. Focused on producing clear statements about the form and content of new development.
- *Systems planning*: 1950s-1970s, resulting from the failure of comprehensive planning to deal with the unforeseen growth of post WWII America. More analytical view of the planning area as a set of complex processes, less interested in a physical plan.
- *Democratic planning*: 1960s. Result of societal loosening of class and race barriers. Gave more citizens a voice in planning for future of community.
- *Advocacy and equity planning*: 1960s & 70s. Strands of democratic planning that sought specifically to address social issues of inequality and injustice in community planning.
- *Strategic planning*: 1960s-present. Recognizes small-scale objectives and pragmatic real-world constraints.
- *Environmental planning*: 1960s-present. Developed as many ecological and social implications of global development were first widely understood.

[153] Ibidem.

[154] D. Walters, *Designing Communities. Charrettes, Masterplans and form-based Codes*, Elsevier Ltd, Oxford 2007.

5.4. Low-rise vs. high-rise

Regarding the city density there are two different approaches: one preferring the low-rise and second high-rise buildings. The high-rise building (residential towers, apartment tower, office tower, apartment block, or block of flats), is a tall building or structure used as a residential and/or office building. In some areas they may be referred to as "MDU" standing for "Multi Dwelling Unit". Emporis Standards defines a high-rise as "A multi-story structure between 35-100 meters tall, or a building of unknown height from 12-39 floors."[155] High-rise buildings became possible with the invention of the elevator (lift) and cheaper, more abundant building materials. The materials used for the structural system of high-rise buildings are reinforced **by** concrete and steel. Most North American style skyscrapers have a steel frame, while residential blocks are usually constructed of concrete.[156] Apartment buildings have technical and economic advantages in areas of high population density, and have become a distinctive feature of housing accommodation in virtually all densely populated urban areas around the world. In contrast with low-rise and single-family houses, apartment blocks accommodate more inhabitants per unit of area of land and decrease the cost of municipal infrastructure.[157] In opposite to the high-rise is defined a low rise building, which is only a few stories tall. There is no universally accepted height requirement for a building to be considered a low-rise. Some define the term as any building that is shorter than a high-rise. Emporis defines a low-rise as "an enclosed structure below 35 meters (115 feet) which is divided into regular floor levels."[158] Some people introduce the term of a mid-rise[159] – for example the city of Toronto defines a mid-rise as a building between 4 and 12 stories. In the USA the National Flood Insurance Program (NFIP) defines low-rise buildings as those containing less than five units, regardless of the number of floors, or containing five or more units in buildings with fewer than three floors, including the basement. For example, single-family homes owned by a condominium association are considered low-rise buildings. A row of units on fewer than three floors or a series of five or fewer units stacked on any number of floors are also considered low-rise buildings. Townhouse and rowhouse buildings are always rated as low-rise, no matter how many units or floors they

155 *Emporis Standards, Data Standards: high-rise building* (ESN 18727), http://www.emporis.com/building/standards/high-rise-building, access 23.04.2014.

156 Encyclopedia Britannica, Inc., access 23.04.2014.

157 http://en.wikipedia.org/wiki/High-rise, 23.04.2014.

158 *Emporis Standards, Data Standards: high-rise building* (ESN 18727), http://www.emporis.com/building/standards/high-rise-building, access 23.04.2014.

159 A. Finder, *Mid-Rise Apartment Houses Making New York Comeback*, "The New York Times", November 23, 1990.

contain. Usually property in low-rise buildings has more building value positioned closer to the floodplain. Therefore, the premiums for the first layers of flood insurance coverage are higher.[160]

There are many pros and cons against high-rise and low-rise buildings. Most high-rise buildings are located near the centre of the city, which may provide a better way of commuting to work. Most of them also include a variety of amenities, including laundry services, pools, convenience stores and even small grocery stores located within the building itself. High-rise buildings always have an elevator while low-rise buildings have or have not. Usually high-rise buildings have live-in supervisors, doormen and concierges who can meet your needs at any hour of the day. But there are some cons of high-rise buildings. Because in high-rise buildings live more people, they are busier and involve more social interaction. For people who like privacy, this can be a disadvantage. Because of the luxurious amenities and superior location, apartments in high-rise buildings tend to be more expensive. Living in a high-rise building, makes that it takes more time to get to the street, and private outdoor space is limited or nonexistent. The low-rise buildings may not offer as much luxury as high-rise buildings, but they are usually cheaper to rent and the price is often negotiable. The residents in low-rise buildings tend to be older, which means you will enjoy less noise, fewer parties and a cleaner environment. Low-rise complexes of buildings are usually located in quieter, residential areas, and offering more privacy. The low-rise apartments are closer to the street that means you need spend less time going from home to your car or public transportation. On the other hand, low-rise buildings can be further from downtown areas, and more time to reach them is needed. Quite often there are only fewer units available, and most units come without extra appliances or furniture. In some cases, there is a necessity to set up own phone, internet, cable and utility services, as landlords are unlikely to do this. They have rarely extra amenities like gardens, pools, fitness centres or laundry facilities and sometimes have no place for parking.

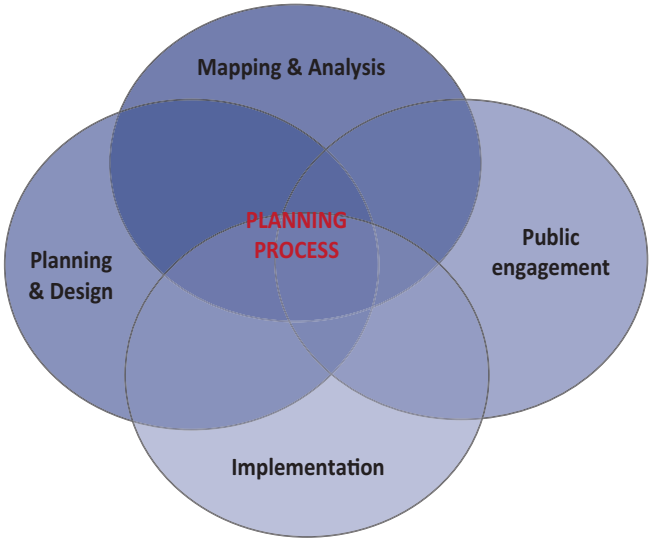
5.5. Planning process

To ensure the success planning process should include a balanced mix of careful analysis of the existing conditions and constraints; extensive and meaningful public engagement; visionary, but practical planning and design;

[160] National Flood Insurance Program, *eWatermark*, http://www.nfipiservice.com/watermark/rightrate_0709.html, access 23.04.2014.

and financially and politically feasible implementation. This applies both to small and large projects. It should be noted that each of the individual elements of the planning process does not operate in a vacuum and we have to take into account the number of overlaps of each component throughout the process.

Figure 5.1. Basic elements of planning process



Source: Adapted from *Southwestern Commission's Regional Toolbox. A Pilot of the Mountain Landscapes Initiative*, Southwestern Planning and Economic Development Commission, the Community Foundation of Western North Carolina and The Lawrence Group Architects of North Carolina, 2009, http://www.regiona.org/wp-content/uploads/2011/06/Toolbox-Complete.pdf, p. 19, access 21.04.2014.

Professional planners developing plans and programs for the use of land play a very important role in the planning process. They conduct research, design, and develop programs; lead public processes; effect social change; perform technical analyses; manage; educate, help create a broad vision for the community development and identify main goals. The primary task of a planner is the creation of a plan focused on communities, population growth, and revitalization of physical facilities in towns, cities, counties, and metropolitan areas. In frame of these tasks planners perform analysis of data and identification of goals for the community or the project. They should identify the strategies by which the community can reach its goals and vision and in further steps coordinate the implementation or enforcement of many strategies, often coordinating the work of many groups of people. We have to remember that every plan can take a variety of forms including: policy recommendations,

community action plans, comprehensive plans, neighbourhood plans, regulatory and incentive strategies, or historic preservation plans. The other forms of plans may also occur including: redevelopment plans, smart growth strategies, economic development strategic plans and site plans.

It is unlikely that one person will have all the skills needed to the planning process. Therefore, in the planning process, it becomes necessary to involve a number of specialists with expertise in different disciplines, and with different professional specializations. Of course the scientific degrees are awarded in the field of planning. In addition to a formal educational background, planners should possess a unique combination of skills that enhances their professional success. In many situations a combination of these skills is helpful.

The contemporary city planners should possess a set of skills that includes knowledge of land, air and water resources, employment trends, cultural diversity and associated issues, the use and needs of new technologies, and conflict resolution. There are many tools, both well established and state-of-the-art, used in the planning process[161]:

- vision and strategy sessions of interested groups,
- ideas fairs to bring together the best of new concepts,
- computer simulations and scale models of plans,
- design workshops,
- social and environmental impact analysis.

A good city planning brings to local communities many different benefits[162]:

1. *Planning creates lasting value* in a community, as opposed to one flashy store, strip centre, or subdivision that looks great for a while until it goes out of style. When citizens have contemplated their future and anticipated what is likely to happen, they will create a more versatile community that can adapt to changes in lifestyles, preferences, and economic trends.
2. *Thoughtful planning tends to result in a wider variety of choices* in types of housing, places to shop, and options for businesses wishing to locate in a community. When a planning and zoning commission and a city council keep up with the times, for example, they would see that more people want to work at home and are able to do so, thanks to computer and

[161] *Planning process*, ACIP, http://www.cip-icu.ca/web/la/en/pa/3FC2AFA9F72245C4B8D2E709990D58C3/template.asp, access 27.04.2014.

[162] N. Thompson, *Good City Planning Gets Results*, http://www.useful-community-development.org/city-planning.html, access 5.05.2014.

communications technology. These elected officials and boards then could clear any zoning or regulatory obstacles to home employment.

3. *Creating or updating a plan allows citizens, business interests, neighbourhood representatives, activists, and civic leaders to come together* every few years to understand one another's needs and requirements better.

Today's modern cities are facing completely new challenges, including meeting energy and transportation needs in a time of growing energy constraints, reshaping building architecture to fit a renewable energy future, changing existing and encouraging new sustainable businesses and industries, and supporting agriculture plants providing locally produced food. To meet these challenges the new projects of sustainable eco-cities of the future must become less available for cars and more walkable "urban villages" connected by transit and combined with a strong downtown centre, protecting space for urban agriculture, and developing urban stream corridors and greenways. Today's cities are too sprawl, their building are too spread all and in effect living in the city requires a vast amount of land, energy, excessive use of means of transport and communication generating large amounts of greenhouse gases causing climate change. To change this unfavourable situation we should reshape cities so that their vital centres – neighbourhood centres, district centres and downtowns – become more diverse in their activities and more compact in their built form. All cities that want to do it need the strategy for shifting of existing development towards increasingly healthy "urban villages" of different scales, from very small to large.[163] They can use new methods of transforming existing cities in new eco-cities with strong concentration of cities amenities lowering carbon emission by reducing vehicle miles travelled. One of these new methods is an eco-city mapping method with using GIS[164] system. Using this method lets calculate distances from residences to amenities such as grocery stores, transit stops, restaurants, schools, and parks. Based on ground topography Eco-city Mapping method uncover existing and potential vitality

[163] *Eco City Mapping for Urban Villages*, www.ecocitybuilders.org/what-we-do/consulting/ecocity-mapping-for-urban-villages/, access 25.04.2014.

[164] GIS – Geographical Information System is a computer system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data. GIS is a system that provides spatial data entry, management, retrieval, analysis, and visualization functions. In a general sense, the term describes any information system that integrates, stores, edits, analyzes, shares, and displays geographic information for informing decision making. GIS applications are tools that allow users to create interactive queries (user-created searches), analyze spatial information, edit data in maps, and present the results of all these operations. Source: Clarke, K.C., 1986. Advances in geographic information systems, computers, environment and urban systems, Vol. 10, pp. 175-184, Maliene V, Grigonis V, Palevičius V, Griffiths S "Geographic information system: Old principles with new capabilities". *Urban Design International* 16(1). (2011), p. 1-6, http://en.wikipedia.org/wiki/Geographic_information_system.

centres and create road maps and transportation systems, water systems, etc., for developing citywide area-specific plans. The Eco-city Mapping method is an innovative and strategic approach to mapping and planning for healthy cities and neighbourhoods placed in natural environmental systems. "The method combines science and technology with community education, outreach and input to describe, communicate, and achieve a shared vision for just and sustainable cities moving towards balance with natural systems."[165] New technologies help in conducting analyses of existing zoning, policies, ordinances and action plans and transforming existing land and energy intensive infrastructure eco-city with compact centres where people live, work and play in natural, green agricultural and recreational environment.

5.6. Eco-city Design Charette

Charrette (an École des Beaux Arts in Paris – derived in the 19th century term for a short, intensive design or planning activity) is a widely known and used method of city planning. "Charrettes originated as a design process used by architects, urban planners and designers to bring together community members, developers and professionals, groups that often hold competing interests and agendas, to address complex projects such as neighbourhood planning, urban development and construction projects. By working together in a charrette, these groups are able to develop feasible solutions that meet everyone's needs."[166]

The charrette can be defined "as an intensive workshop in which various stakeholders and experts are brought together to address a particular design issue, from a single building to an entire campus, installation, or park. The term can also be applied to shorter, focused project team meetings, project planning meetings, brainstorming sessions, and extensive community visioning events".[167] In a similar way was defined the charrette method in The Neighbourhood Charrette Handbook: "The charrette workshop is designed to stimulate ideas and involve the public in the community planning/design process. It is a valuable tool for laying the foundation for the development of

[165] *Eco city Mapping for Urban Villages*, Eco-city Builders, June 30 2009, p. 6, http://www.ecocitybuilders.org/wp-content/uploads/2010/11/EcocityMappingFinal.pdf

[166] *The Dublin Charrette. Taking Public Service Delivery To the Streets*, November 5-9 2012, http://worldhouse.ca/wp-content/uploads/2012/11/The-Dublin-Project-Handbook-DIGITAL-LO-RES.pdf, access 28.04.2014.

[167] J.A. Todd, *Planning and Conducting Integrated Design (ID) Charettes. Whole Building Design Guide. A program for the National Institute of Building Science*, http://www.wbdg.org/resources/charrettes.php#intro, access 27.04.2014.

a more formal plan (i.e. comprehensive plan, master plan, strategic plan, etc.). It is the most effective as a component of the formal planning and design process."[168] And another definition says "A charette is a structured, collaborative session in which a group comes together to develop a solution to a problem. It has been used in fields such as architecture, community planning, and engineering for years – bringing together a variety of different points of view to solve a difficult problem, often using the familiar six-step planning process as a key tool."[169] Charrette is "an innovative way to engage the public and key stakeholders in a collaborative process, eco-city design charrettes are exciting, meaningful and interactive special workshops that include community members, design professionals, and other project staff. The goal of the charette process is to capture the vision, values, and ideas of the community – with designers sketching to create alternatives and ideas as they are generated by the participants."[170] Charrettes are frequently applied in the context of land use planning to support revitalization efforts, including brownfield assessment, cleanup, and reuse. This is a very effective approach for incorporating stakeholder engagement and collaboration into the sustainability assessment process. The advantage of the method is the fact that it helps community organizations, public agencies, developers, and other stakeholders to work together to identify more sustainable alternatives, technical solutions, and barriers to implementation, and look for vision of future development, their city and community. The idea of charrettes is strongly supported by organizations and institutions like the Congress for the New Urbanism, the Smart Growth Network, and the National Charrette Institute. A detailed history of charrettes is provided in The Charrette Handbook[171], published by the American Planning Association. In the classical approach, this method is implemented in the form of workshops with the physical participation of all interested stakeholders. Now, thanks to advanced possibilities offered by advanced ICT technologies it is possible to realize charrette as digital process.[172]

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168 J.A. Segedy, AICP and B. E. Johnson, AICP, *The Neighborhood Charrette Handbook*, http://www.michigantownships.org/downloads/charrette_handbook_2.pdf, access 27.04.2014.

169 Conducting a SMART Planning Charrette, A Handbook for Project Development Teams, http://planning.usace.army.mil/toolbox/library/smart/Charette%20Handbook.pdf, access 27.04.2014.

170 http://www.ecocitybuilders.org/what-we-do/education/ecocity-design-charrettes/, access 30.04.2014.

171 B. Lennertz, A. Lutzenhiser, *The Charrette Handbook. The Essential Guide for Accelerated, Collaborative Community Planning*, American Planning Association, Chicago 2006.

172 Digital Charrette Handbook, *Using INDEX Plan Builder In Real-Time*, Prepared for the Florida Department of Community Affairs, July 2007, http://sparcindex.wikispaces.com/file/view/digitalcharretting.pdf/428180534/digitalcharretting.pdf, access 27.04.2014.

According to CharreetteCenter.net the city (urban) planning has three stages[173]:

Stage 1. *Info gathering.*

In the first stage the design team listens to the views of the stakeholders and citizens while examining the project area and its context with the help of local experts. Identification workshops are held to discuss issues that the stakeholders feel are important to the development. There is often a kickoff presentation and reception the first evening.

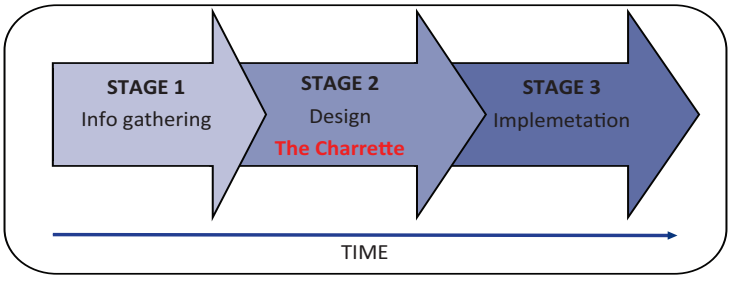
Stage 2. *Design and review*.

The design team, armed with this information, proceeds to collaborate about the best uses for the area. Starting with general large-scale issues such as important natural features and development patterns, the debates and designs eventually evolve to fine grain issues such as landscape standards and appropriate mixes of building types. At regular intervals, the public is invited to review the team's progress and then give comments on what they see.

Stage 3. *Presentation*

The charrette ends with a final presentation of designs and findings. The presentation is highly graphic with lots of drawings that communicate the team's recommendations. A final report or design manual that summarizes and illustrates the plan and design is then assembled and delivered to the community. This document is used to help restate the goals identified during the charrette and to supply a guiding vision during implementation. A charrette plays the most important role in the city design process on stage two.

Figure 5.2. Charette in three stages city (urban) planning process



Source:

[173] J. Schommer, *A scharrette is the center of urban design process*, http://www.charrettecenter.net/charrettecenter.asp?a=spf&pfk=7, access 29.04.2014.

In its original form design charrettes largely remain the planning method, used both for internal project analysis and synthesis of large volumes of complex information. Most often were used as tools for engaging the community in participatory workshops on potentially controversial developments. But the design charrette as developed in the field of planning and urban design is also a method of engaging professionals in businesses and organizations seeking ongoing innovation. Charrette has a strong potential for "stimulating *innovation through drawing* as a way of collaborating with stakeholders outside of the key design professions"[174] and is seen not only as a method of engaging with creativity to generate new products or services but if focused on decision making can play important role in planning and developing a business ecosystem. To outsource for creative input, rather than retain staff trained in new product or service design can be very useful for business organizations.

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[174] N.D. Smith, *Design Charrette: A Vehicle for Consultation or Collaboration*, Curtin University, Perth, https://www.academia.edu/1277880/Design_charrette_A_vehicle_for_consultation_or_collaboration, access 30.04.2014.

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Chapter 6

Transportation planning and management

Mariusz Zabielski

Introduction

Safe, comfortable and fast transportation – adapted to meet the diverse needs of residents during a time of dynamic development of technology and ongoing globalization processes – has strategic importance in the economy of cities.

"Chicago is a city on the move, and we must be able to move our residents with the speed and comfort that mark modern transportation." – Mayor of Chicago Rahm Emanuel

Unfortunately, in recent years, in the age of heavy traffic, in both cities and outside of their borders, transport has become one of the main sources of atmospheric pollution aside from energy production, industry as well as household and welfare sector (especially road). Currently, transport is responsible for about 20% of the world's carbon dioxide emission (in Europe this ratio is 28-30%). Since 1990 the emissions from the road transport have increased by 22%.[175]

According to research, cars have the largest share in poisoning the atmosphere of around 30%, and in the case of large cities up to 70-90%. They are the most hostile means of transport to the natural environment. "They cause the greatest pollution and threat to wildlife, emitting large amounts of harmful substances into the atmosphere such as carbon dioxide, hydrocarbons and nitrogen oxides. CO_2 emission caused by cars is approximately five times greater than CO_2

[175] P. Wójcik, *Polish hybrid on foreign roads* [*Polska hybryda na niepolskich drogach*], „Środowisko" 13/2008, No. 373, page 32.

pollution from busses, approximately five hundred times greater than tram's emission and close to one thousand times more than a metro. Comparable differences in the poisoning of the environment by a car – in comparison to other means of transport – are in the case of hydrocarbons."[176]

In the light of the foregoing, **one of the main objectives for a cities' transport policies** (aside from the safety, comfort and speed mentioned in the introduction) **is to reduce negative influence of transport on the environment** by promoting balanced road transport and introducing attractive alternatives for residents travelling around cities in passenger cars.

Definition 6.1. Transport

Transport, the set of factors involving the movement of people and commodities with the aid of appropriate means. It includes both the movement from place to place and all the activities necessary to achieve this objective, i.e. loading activities (loading, unloading and transhipment) as well as handling operations (e.g. fees).

Means of transport:

- Transport categories in respect to the environment in which the movement of people or commodities is performed:
  - **land**, divided into surface (road), underground (i.e. metro) and above-ground (i.e. overhead railway), as well as rail transport (railway) and non-rail (vehicles);
  - **water** (maritime, inland waterway);
  - **transmission** (pipelines, cables or conveyor);
  - **air** (aviation), where, depending on the type of propulsion can be divided into motorised and non-motorised transport.
- Depending on the cargo type, transport can be divided to:
  - **freight**;
  - **passenger**.

It may have a universal character (transportation of various cargo or amounts of people) or specialised (transportation of one or more types of cargo such as in refrigerated vehicles or groups of people, i.e. in sanitary or military vehicles).

- Depending on the accessibility for users, transport can be divided to:
  - **public**, available to any user;
  - **individual** (private), meeting the transport needs of a particular person and/or family.
- Depending on the territorial coverage, transport can be divided to:
  - **far**;
  - **close**.

Source: Own elaboration based on: http://encyklopedia.pwn.pl/haslo/3988780/transport.html

The main objective of this chapter is to draw attention to the fact that cities through planning and managing urban transportation have a wide range of available solutions enabling them to "fight" the ever increasing number of

[176] J. Zyśk, *Less energy, less emission* [*Mniej energii, mniej emisji*], „Środowisko" 18/2009, No. 402, page 16.

vehicles on the streets (it is estimated that the number of cars in the world in 2020 will exceed 1.2 billion which is 2 times more than today), and thus greater: **fuel consumption, noise level, traffic and, as a result, more environmental pollution**. There is no doubt that the above-mentioned solutions have beneficial effects on the environment and health but also have additional benefits such as a positive influence on:

- reducing the number of collisions,
- reducing the travel time,
- possibility to predict travel time,
- reducing the noise level,
- reducing the stress resulting from time-consuming traffic jams.

A synthetic analysis of the regulation policy of the European Union in respect to road transport carried out at the end of April 2014 is an additional objective of this elaboration. Legal regulations will be subject to further changes in the near future thus gradual checking and updating is necessary.

This chapter is rich in examples and experience of many cities from around the world. These examples are supported by figures as well as numerous diagrams and photos.

6.1. The European Union's legislation in transport

The European Union from 1992, i.e. from the first publication of the Commission's White Paper on "the future development of the common transport policy", promotes a common transport policy. It is implemented in several directions which, among others, are:

- liberalisation of transport conditions between Member States,
- improvement of transport quality and safety,
- reduction of transport's negative influence on the environment,
- defining the standards and work conditions of the social area for people employed in transport.

The common transport policy of the EU based on the experience of many Member States helps develop tools which makes it possible to achieve the above-mentioned goals like reducing the negative influence of transport on the environment. For this goal to be achieved, "the overall transport policy should be conditioned by ecological and spatial planning as well as finding the proper proportions between investment in new roads and railways and maintaining, upgrading and better use of the existing ones, among others, through the use of

modern management systems and promotion of public rather than individual transport".[177]

Currently, 44% of cargo transportation in the European Union is conducted by road transport. For the purposes of comparison, transportation carried out by rail is 8% (the remaining participation in cargo transportation is: 41% of transport is carried out by maritime transport and 4% of transport is carried out by the inland waterway transport). An even larger participation of road transport can be noticed in passenger transport, where road transport is 79% of the market while railway transport reaches is at a level of 6% and air transport is 5%.[178] Keeping this in mind, it is not surprising that road transport in the European Union is responsible for producing 28-30% of the carbon dioxide emission, mainly from greenhouse gas, but due to the negative impact on the natural environment it plays a key role in economic and social life. With this in mind, the European Union strives for the reduction of fuel consumption, the reduction of the exhaust gas and noise emissions by persuading the use of, e.g., alternative fuels. The harmonization of technical and fiscal provisions as well as the development of sustainable transport will help to achieve this goal.[179]

In view of the above the European Union introduced and continues to implement a number of legal regulations in order to reduce the negative influence of transport on the environment.

One of such regulations is the "polluter pays" principle. It is regulated by Article 191 Para. 2 of the **Official Journal of the European Union C 83 of 30 March 2010**, which states that "Union policy on the environment shall aim at a high level of protection taking into account the diversity of situations in the various regions of the Union. It shall be based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay".[180]

The "polluter pays" principle is to be understood in the way that perpetrators of damage to the environment, whether they are natural persons or legal entities, should be responsible for the costs of preventive actions or repairing the damage. This means that the entity that has a negative influence on the natural environment should be identified and then punished even with a financial penalty. The European Union's main objective of introducing this principle was to convince entities to use new technologies which will much less

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177 M. Popławska, *Spatial planning and nature preservation. Ecosystems in danger* [*Planowanie przestrzenne a ochrona przyrody. Zagrożone ekosystemy*], „Środowisko", 11/2009, No. 395, page 13.

178 http://www.psm.pl/ue/?k=bk&pl=2 (from 29.5.2014)

179 A. Pieniak, A. Niewczas, *Selected European Union legislation in road transport*, Zeszyty Naukowe WSEI seria Transport i Informatyka 1 (1/2011), Wydawnictwo Naukowe of the University of Economics and Innovation in Lublin, page 79.

180 Art. 191 Para. 2 of the Official Journal of the European Union C 83 of 30 March 2010

interfere with the environment. Currently it is limited only to the fees for the use of the road infrastructure and external costs of road transport.[181]

Some of German cities can be a good example of the "polluter pays" principle. From 1 January 2008 Berlin, Hannover and Köln as the first cities introduced a requirement to have a special badge that allows entering so-called "green zones" (a list of the cities which have green zones is available on the website of the Embassy of the Republic of Poland in Berlin). This obligation applies to both cars registered in Germany and outside of its borders.

Cars and lorries which are marked with a red, yellow or green badge with the vehicle's registration number written on it have the right to enter the "green zone" (called "Umweltzone"). The type of badge depends on the exhaust gas emission standard that the vehicle meets. The table 6.1 presents the mandatory classification of vehicles including the allocation to the proper group of harmful emissions. Vehicles excluded from this requirement are motorcycles, police cars, fire department vehicles and ambulances.[182]

The badges are valid indefinitely throughout Germany. Their lack is punished with a fine of EUR 40.00.

Table 6.1. Vehicle classification including the allocation to the proper exhaust gas emission group

Badge	Emission standard	Group of harmful emissions	First registration of a passenger car	First registration of a lorry
Petrol engine				
cannot receive	EURO 1 or older (without catalyser)	1	before 1.1.1993	-
	EURO 1 or higher	4	from 1.1.1993	-
Diesel engine				
cannot receive	EURO 1 or older	1	before 1.1.1997	before 1.1.1996
	EURO 2/ EURO 1 + filter	2	from 1.1.1997 to 31.12.2000 r.	from 1.1.1996 to 30.09.2001
	EURO 3/ EURO 2 + filter	3	from 1.1.2001 to 31.12.2005	from 1.10.2001 to 30.09.2006
	EURO 4 / EURO 3 + filter	4	from 1.1.2006	from 1.10.2006

Source: Own elaboration based on: http://berlin.msz.gov.pl/pl/informacje_konsularne/ruch_drogowy_i_transport_1610/zielone_strefy?printMode=true

[181] A. Pieniak, A. Niewczas, *Selected European Union legislation in road transport*, Zeszyty Naukowe WSEI seria Transport i Informatyka 1 (1/2011), Wydawnictwo Naukowe of the University of Economics and Innovation in Lublin, page 80.

[182] http:/berlin.msz.gov.pl/pl/informacje_konsularne/ruch_drogowy_i_transport_1610/zielone_strefy?printMode=true (of 29.5.2014).

What is the purpose of the above-mentioned "green zones"? Their main goal is to reduce air particulate pollution. Additionally, they reduce local car traffic within the "green zone" (usually city centres), so it is possible to reduce the number of traffic congestions and noise emission. All of the above-mentioned factors negatively affect the environment and are defined as external costs of road transport (external costs are costs incurred by the environment due to a factor's activity).

A second example of the "polluter pays" principle that functions well is the Low Emission Zone (LEZ) in London. This area covers almost the entire Greater London (figure 6.1) and operates 24 hours, 7 days a week, for a whole year.

Figure 6.1. Low Emission Zone (LEZ) – London

Source: http://www.fta.co.uk/export/sites/fta/_galleries/downloads/low_emission_zone/lez_map.gif

The entry to the LEZ is specially marked (photo No. 6.1) and applies to vehicles registered both in the UK and outside of its borders. The goal of the Low Emission Zone in London is the same as the "green zones" in German cities in order to improve air quality by eliminating from the road vehicles causing large pollution to the natural environment. Despite many similarities these two zones differ from each other by few major assumptions, such as:

- **zone boundaries** – remember that the LEZ covers almost all of Greater London – Figure 6.2, and "green zones" occur only in the city centres – Figure 6.1;
- **types of vehicles** – remember that cars and lorries which are marked with a special badge have the right to enter a "green zone". In the case of the LEZ, the restrictions only apply to old lorry models with diesel engine, coaches, buses, minibuses, large vans as well as caravans and horse carriages. Therefore, the LEZ program does not include passenger cars, motorcycles and small vans;
- **fees** – remember that the badges allowing entrance to the "green zone" are valid indefinitely throughout Germany and their cost starts from PLN 89 (source: www.dekra.pl on 29.5.2014). As to the LEZ, the drivers of vehicles which do not meet exhaust gas emission standards should make every effort (modifications or changes) to meet the above-mentioned standards. If not, they will be forced to pay a daily fee of £100-200 depending on the type of vehicle. The lack of the fee payment results in a fine of £500.

Photo 6.1. Low Emission Zone entry sign

Source: http://www.tfl.gov.uk/modes/driving/low-emission-zone/about-the-lez?intcmp=2263

Another example of the "polluter pays" principle is the largest Danish cities (Copenhagen, Aarhus, Odense and Aalborg) in which from 1 November 2011 all buses and lorries travelling through the limited traffic zone must have a Danish ecological badge. This requirement also applies to all vehicles weighting over 3.5 tonnes with a diesel engine.[183]

Currently in 15 countries of the European Union almost 150 Low Emission Zones operate of which 72 of them are in Germany.

Table 6.2. List of operating Low Emission Zones

Country	Number of operating LEZ	Selected cities
Austria	6	Graz, Tirol, Vienna
Belgium	1	Antwerp
Czech Republic	1	Prague
Denmark	5	Aalborg, Copenhagen, Odense
France	1	Mont Blanc Tunnel
Germany	**72**	Augsburg, Berlin, Dortmund, Essen, Frankfurt, Hannover, Ingersheim, Karlsruhe, Leipzig, Mainz, Munich, Stuttgart, Ulm
Greece	1	Athens
Hungary	1	Budapest
Italy	20	Bologna, Florence, Milan, Palermo, Napoli, Parma, Turin, Verona
Malta	1	Valetta
Netherlands	14	Amsterdam, Breda, Den Haag, Eindhoven, Rijswijk, Rotterdam, Utrecht.
Norway	7	Bergen, Oslo, Trondheim
Portugal	1	Lisbon
Sweden	10	Gothenburg, Malmo, Stockholm
Great Britain	6	London, Norwich, Oxford

Source: Own elaboration based onhttp://www.lowemissionzones.eu/ (of 29.5.2014)

The European Union has launched a website (http://www.lowemissionzones.eu/) where information on all LEZs can be found.

A second regulation of the European Union aimed at reducing the negative influence of road transport on the environment is **Directive 2009/33/EC of the European Parliament and of the Council of April 23, 2009 on the promotion of clean and energy-efficient road transport vehicles.** This Directive aims to "stimulate the clean and energy-efficient road transport

[183] http://www.stowarzyszenie.szn.pl/2011/08/wjazd-do-wiekszych-miast-w-danii-tylko-z-plakietka-ekologiczna/ (of 20.5.2013).

vehicles, and especially – since this would have a substantial environmental influence – to influence the market for standardised vehicles produced in larger quantities such as passenger cars, buses, coaches and trucks, by ensuring a level of demand for clean and energy-efficient road transport vehicles which is sufficiently substantial to encourage manufacturers and the industry to invest in and further develop vehicles with low energy consumption, CO_2 emissions, and pollutant emissions".[184]

Given the above, this act imposes an obligation on the contracting authorities, entities as well as certain operators to consider the energy factor and environmental influence during the operational lifetime of the vehicle including energy consumption and carbon dioxide emissions when purchasing road transport vehicles.[185]

Categories of road transport vehicles and their mileage during the whole operational lifetime is presented in table No. 6.3.

Table 6.3. The mileage of road transport vehicles during the whole operational lifetime

Type of vehicle	Category	Description of the category	Mileage during the life cycle
Passenger cars	M_1	**M:** Vehicles designed and operated in order to carry passengers and their baggage. **1:** Vehicles with not more than eight seats in addition to the driver's seat.	200 000 km
Light lorries	N_1	**N:** Engine vehicles designed and operated for the purposes of carriage loads. **1:** Vehicles with a maximum weight not exceeding 3.5 tonnes	250 000 km
Heavy duty vehicles	N_2	**N:** Engine vehicles designed and operated for the purposes of carriage loads. **2:** Vehicles with a maximum weight exceeding 3.5 tonnes but not exceeding 12 tonnes.	1 000 000 km
	N_3	**N:** Engine vehicles designed and operated for the purposes of carriage loads. **3:** Vehicles with a maximum weight exceeding 12 tonnes.	1 000 000 km

[184] "Official Journal of the European Union" No. L 120 of 15 May 2009, page 6.

[185] A. Erechemla, *Promotion of clean and energy-efficient vehicles [Promowanie ekologicznie czystych i energooszczędnych pojazdów]*, „Środowisko", 12/2009, No. 396, page 19.

Buses	M_2	**M:** Vehicles designed and operated in order to carry passengers and their baggage. **2:** Vehicles with a maximum weight not exceeding 5 tonnes, with more than eight seats in addition to the driver's seat	800 000 km
	M_3	**M:** Vehicles designed and operated in order to carry passengers and their baggage. **3:** Vehicles with a maximum weight exceeding 5 tonnes, with more than eight seats in addition to the driver's seat.	800 000 km

Source: Own elaboration based on: Directive 2009/33/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of clean and energy-efficient road transport vehicles and Directive 2007/46/EC of the European Parliament and of the Council of 5 September 2007 establishing a framework for the approval of motor vehicles and their trailers and of systems, components and separate technical units intended for such vehicles.

This Directive shall apply to contracts for the purchase of road transport vehicles by[186]:

- contracting authorities or contracting entities as far as they are under an obligation to apply the procurement procedures set out in Directives:
  - **2004/17/EC** of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors;
  - **2004/18/EC** of 31 March 2004 on the coordination of procedures for the awarding of public works contracts, public supply contracts and public service contracts;
- operators for the discharge of public service obligations under a public service contract within the meaning of Regulation No. **1370/2007/EC** of the European Parliament and of the Council of 23 October 2007 on public passenger transport services by rail and road in excess of a threshold which shall be defined by Member States not exceeding the threshold values as set out in Directives 2004/17/EC and 2004/18/EC.

Member States shall ensure that in accordance with this Directive all contracting authorities, contracting entities and operators when purchasing road transport vehicles, take into account the operational lifetime energy and environmental influence. In order for the mentioned requirements to be kept the contracting authorities, contracting entities and operators should set

[186] Art. 3 Directive 2009/33/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of clean and energy-efficient road transport vehicles.

technical specifications for energy and environmental performance in the documentation for the purchase. Additionally, in case of a procurement procedure, these factors should constitute the award criteria.[187]

As practice shows, these guidelines are obviously taken into account in awarding tenders but still the low price is the main criterion. For example, a call for tender announced by MZA Warsaw to purchase 10 electric buses where the low price criterion was 90% of the awarded points (10% were non-price criteria such as, among others, energy consumption). Such tender assumptions promoted cheap products regardless of their quality (in this case the winning tenderer offered buses that were characterised by energy consumption of 108 kWh/100 km, while one of the unsuccessful tenderers offered more expensive buses but characterized by lower energy consumption of 84 kWh/100 km).

The another EU legislation act aiming for the care of the natural environment is the **"Clean power for transport" Directive** which on 20 March 2014 was finally approved and forwarded for implementation. Its main objective is to reduce the European Union's dependence on crude oil as well as reducing transport exhaust gas emissions.

According to this Directive, Member States of the European Union are obliged to build[188]:

- a network of compressed natural gas CNG fuelling stations[189] and energy stations in all European metropolitans by 2020;
- a network of CNG and LNG[190] fuelling stations for transit transport along TEN-T[191] transport routes by 2025. Whereas the maximum distance between CNG stations may be 100 km and 400 km between LNG stations;
- LNG bunkering points (refuelling) for maritime vessels in ports situated on TEN-T transport routes by 2025;
- LNG bunkering points for inland waterway vessels in ports situated on TEN-T transport routes by 2030.

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187 A. Erechemla, *Promotion of clean and energy-efficient vehicles [Promowanie ekologicznie czystych i energooszczędnych pojazdów]*, Środowisko, 12/2009, No. 396, page 20.

188 http://www.cng.auto.pl/pl/component/content/article/140-news-2014-i/1546-cng-lng-dyrektywa-czysta-energia-dla-transportu.html

189 **CNG** (*Compressed Natural Gas*) is fuel – natural gas in compressed form. There are over 4 million vehicles with compressed natural gas in the world. There are more than 8 thousand functioning CNG fuel stations. – http://cng.auto.pl/

190 **LNG** (*Liquefied Natural Gas*) is liquefied methane-rich natural gas that has been converted to liquid form for ease of transport and storage in places beyond the reach of traditional natural gas stations. – http://cryogas.pl/lng

191 **TEN-T** (*Trans-European Transport Networks*) is the EU's programme aiming to unify the European transport area (road, rail, water and air networks) – striving to achieve a competitive and resource efficient transport system – http://ec.europa.eu/transport/themes/infrastructure/index_en.htm

Table 6.4. Comparison of CNG and LNG stations availability in selected EU countries

Selected EU countries	Number of CNG and LNG stations	Number of residents	Number of residents per CNG and LNG station
Poland	25	38.5M	0.065
Czech Republic	52	10.5M	0.495
Germany	920	80.3M	1.146
Slovakia	14	5.4M	0.259

Source: Own elaboration based on: B. Kamiński, K. Wieczorek, Comments of the cng.auto.pl website on the transport development strategy in 2014-2020.

Table 4 presents the availability of CNG and LNG stations in selected countries of the European Union. Large deficiencies in Poland's current availability of alternative fuel stations in comparison to other Member States can be concluded on its basis (25 stations per close to 38.5 million residents gives 1 station per more than 1.5 million residents).

The cost of building one CNG station is around EUR 250,000.00 and one LNG station EUR 400,000.00 according to the calculations submitted by the European Commission. According to these same estimates the European Commission has determined that in addition to the existing CNG stations in Poland it is necessary to build 51 additional facilities (EUR 13M), and to the existing LNG stations an additional 15 (EUR 6M).[192]

This Directive has obliged some countries (which volunteered) to construct a network of hydrogen fuelling points in urban areas by 2025.

Additionally, the European Commission in planning to reduce the CO_2 in transport by 60% by 2050, proposed a minimum number of electric vehicle charging points for each Member State. Poland would be obliged to build 460k electric vehicle charging points by 2020.

The above description is only a part of the legislation introduced by the European Union, aiming to reduce the negative influence of transport on the natural environment. In fact, there is much more and these include:

- Decision No. 1600/2002/EC of the European Parliament and of the Council of 22 July 2002 laying down the Sixth Community Environment Action Programme;
- The *Green Paper* of the European Commission of 25 September 2007 titled "Towards a new culture for urban mobility";

[192] http://www.cng.auto.pl/pl/component/content/article/133-eventy-2013/1252-komisja-europejska-czysta-energia-dla-transporrtu-paliwa-alternatywne-cng-lng-gaz-ziemny-metan-warszawa-kwiecien-2013.html (of 29.5.2013).

- The resolution of the European Parliament of 22 October 2007 on the Community Strategy to reduce CO_2 emissions from passenger cars and light-commercial vehicles 2007/2119(INI).

6.2. Ecological transport city

City transport planning and management is a very difficult, time-consuming and laborious activity that requires multiple competencies. Those responsible should have the broad knowledge, rich experience and appropriate professional training to coordinate a series of organizational, legal, financial and technical activities, among other things.

The vision of transport should be looking forward and consider a number of important factors affecting its development, i.e.:

- **city area** – which in the case of large and extensive cities determines introducing new solutions such as trains, metro or ring roads;
- **number of inhabitants and population density** – of the entire city and its individual districts, settlements or even streets;
- **planned increase/decrease in the number of inhabitants** – often resulting from upward or downward tendencies between the last several years. A prognosis of any changes in the population should also include plans of new jobs (e.g. at a production plant) or scheduled layoffs in a negative sense. It should be noted that usually new employees settle in the city together with their families;
- **existing infrastructure** – which is existing roads, railway tracks, bus stops, railway stations, etc.;
- **existing fleet** – of cars, buses, trams or railway rolling stock;
- **financial conditions** – which are one of the major barriers for the development of transport. Keeping this in mind, when planning to start transport development it should depend mainly on the available financial resources. Remember also that nowadays a clever manager has many possibilities to obtain additional money even in the form of the EU funding;
- **availability** – of the constructed infrastructure and new communication networks in places which are or will be easily accessible to the users;
- **environment protection** – should be considered already at the planning stage by implementing solutions that reduce the negative influence of transport on the environment. A number of these solutions will be described in this chapter.

- **direction of city development** – understood as the currently weak or average urbanized direction which now or in the future will be attractive to potential investors and residents, for example due to a convenient communication system;
- **"bottlenecks"** – which are streets with repeatedly create congestions;
- **natural barriers** – such as mountains, lakes, rivers and forests, that usually block the growth of the city in a particular direction;
- **spatial planning** – including introduction of the local spatial development plan so that those who are responsible for transport planning may specify which region the city should most likely develop. In Poland, it is currently at the legislative stage and therefore there is a big opportunity of integrating effective transport with the spatial planning. This situation also allows a relatively quick and simple way to change the use of land, for example, for the objectives related to transport;
- **land ownership structure** – which often reduces the ability of road or rail investments through long and costly expropriation procedures;
- **long-term contracts with companies** – such as: land lease agreement, release for perpetual usufruct agreement or space rental in existing buildings. These contracts are a kind of security that give a guarantee and clear signal to the city that the businessman and his company plan to remain in the city longer.
- **transit** – used well can be a revival factor for a city.

> *"Sustainable cities will never appear if the transport system is not sustainable. Increasing energy consumption, extensive travel and poor natural resource management must be redirected. Urban sprawl and the need to commute great distances for work and shopping must be curbed."*[193] – Natalija Kazlauskiene, director, Directorate General for Regional Policy, European Commission,

A very good example of transforming vision into reality is projects planned and implemented by Copenhagen (the "Finger plan") and Singapore (the "Constellation plan").

Copenhagen's Finger Plan is a textbook example of the long-term vision planning of shaping railway investments in the city.[194] When in 1947 the group of town planners sat down and laid out a practical development plan of Greater Copenhagen they realized that their sketches resemble the shape of a hand

[193] H. Suzuki, R. Cervero, K. Iuchi, *Transforming Cities with Transit. Transit and Land-Use Integration for Sustainable Urban Development*, Urban Development Series, The World Bank, Washington DC 2013, page 22.

[194] Ibid, page 53.

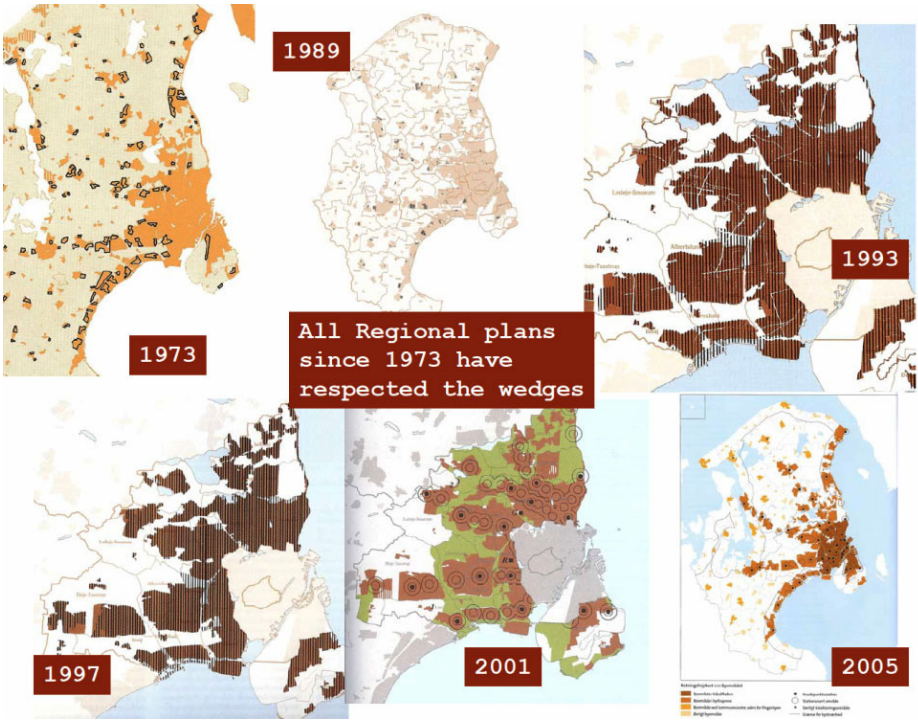
(figure No. 6.2). The "palm of the hand" was on the existing city centre and the "fingers" (according to the planners) were to be corridors along which, in the future, the city development was to be constituted. Initially, the built infrastructure of the railway's capacity significantly exceeded the demand for transportation of people and commodities but over the years residents of Copenhagen began to appreciate the merits of the protection wedges (located between the fingers) and thus they have easy access to agricultural products, natural habitats, forests and beautiful landscapes.[195] The city's development over the last several years is presented in figure No. 6.3.

Figure 6.2. Copenhagen's Finger Plan

Source: http://www.designboom.com/weblog/images/images_2/lauren/farum/fa09.jpg

[195] http://www.greenbelt.ca/high_five_for_the_copenhagen_finger_plan_2011 (of 30.5.2014).

Figure 6.3. Territorial expansion of Copenhagen over the last several years



Source: http://ericwinkelmann.wordpress.com/2012/09/28/plan/ (of 30.5.2014).

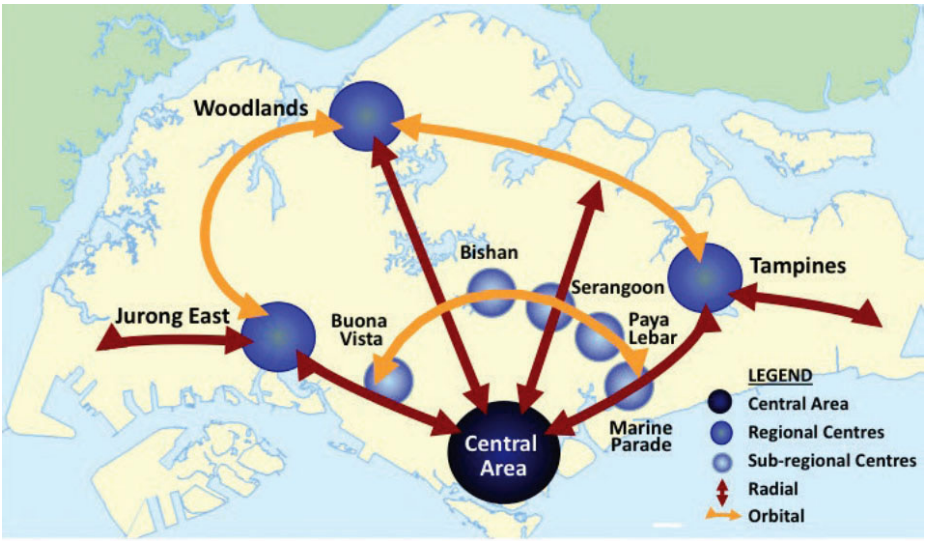
The "Finger plan" vision continued and implemented over the years enables the present residents of Copenhagen quick and safe transport to and from the city centre as well as easy access to work centres and housing estates. It also allows the transport managers to focus their attention and resources mainly on improving existing communication solutions. This project is a perfect example of how transport may affect and control the growth of the city. Unfortunately, in most cities the reversed trend is currently observed.

The undoubted and invaluable advantage of communicating the city in this way (i.e. using trains and metro as the main means of transport in the city which, as written before, significantly friendlier for the environment) is **significantly reduced road traffic and, as a result, the elimination of congestions and noise level reduction, thus the radically decreasing the negative influence of the road transport on the environment**.

The second example is **Singapore's Constellation Plan,** based on the Scandinavian planning principles which use radial corridors connecting the city

centre (the core) with the planned new suburbs or outskirts (planets). All of it looks like constellation of satellite planets on the spatial plan which surrounds the core. They are separated from it with protective greenbelts intertwined with **high-quality and high-performance** railway tracks for quick and **safe railway transport** which is also **friendlier to the environment** than road transport (figure No. 6.4).

Figure 6.4. Singapore's Constellation Plan



Source: H. Suzuki, R. Cervero, K. Iuchi, *Transforming Cities with Transit. Transit and Land-Use Integration for Sustainable Urban Development*, Urban Development Series, The World Bank, Washington DC 2013, p. 71.

As another interesting example of city transport planning from scratch is **Masdar City** – a city which contraction began in 2006. This is the first project of an emission-free and waste-free city in the world that is supplied entirely with electric energy from renewable sources. 50,000 residents are to live in the area of approximately 6 km^2 and 1,500 companies will have their registered offices there.[196]

The transport plan includes the elimination of cars at the expense of three main means of transport[197]: **walking** (numerous passageways, sidewalks and squares at ground level), a **light rail system** (the transportation will take place below the surface) and an elevated **personal rapid transit system** (PRT).

[196] http://technowinki.onet.pl/masdar-city-ekologiczne-miasto-przyszlosci/ekt07 (of 31.5.2014).

[197] J. Ekblaw, E. Johnson, K. Malyak, *Idealistic or realistic? A comparison of Eco-city typologies*, Green Cities, 2009, page 5.

This integrated system includes within its plans building public transportation stops in a distance of every 200 meters.

What is Personal Rapid Transport? It is a concept of a rapid urban transport based on electric taxis which do not need a driver. PRT vehicles can move only on specially prepared routes (over ground, elevated or suspended)[198]. Currently, there is an operating PRT system, among others, the ULTra system, at Heathrow Airport in London (photo No. 6.2).

Photo 6.2. PRT ULTra system (Heathrow Airport)

Source: http://www.fhwa.dot.gov/advancedresearch/pubs/12033/004.cfm

The last example is the **Sjöstad Hammarby** housing estate **in Stockholm** which was founded in industrial areas. The Hammarby Sjöstad housing estate is located around Hammarby Lake and includes the area of about 250 ha. Its revitalisation continuous until today and is planned to finish in 2018. "Hammarby Sjöstad is one of several "new-towns/in-towns" created based on Stockholm's 1999 city plan, which set forth a vision of "building the city inward."[199] The main goal of this residential area is **to reduce the negative influence on the environment** through saving energy which is possible by using renewable energy sources and **minimizing car transport in favour of public transport, cycling and walking**.[200]

198 http://pl.wikipedia.org/wiki/Personal_Rapid_Transit (of 31.5.2014).

199 H. Suzuki, R. Cervero, K. Iuchi, *Transforming Cities with Transit. Transit and Land-Use Integration for Sustainable Urban Development*, Urban Development Series, The World Bank, Washington DC 2013, page 57.

200 http://pl.wikipedia.org/wiki/Hammarby_Sj%C3%B6stad (of 29.5.2014)

"Special energy saving" trams run every seven minutes in peak hours and provide five-minute connections to Stockholm's metro underground network and commuter trains. Rail stations are well designed and fully weather protected, and they provide real-time arrival information. The city's buses run on biogas produced by local wastewater processing."[201]

Many kilometres of bicycle and pedestrian paths were designed and constructed along the main avenues and bridges which are properly illuminated and secured so that the user would feel comfortable and safe. Additionally, a large bike parking lot is located before every building.

There are three car rental offices in this residential estate that provide access to 37 low emission vehicles which reduces even more the need for owning a car in Hammarby Sjöstad. This area was designed with the requirement to provide only 0.25 parking spaces per apartment (in Poland the standard is from 0.5 to 1.0). All the commercial parking lots available in the residential estate are payable and the high prices effectively discourage leaving cars for longer periods. An addition, a fee is charged for cars entering the district, which is a kind of incentive to use public transport, walk or cycle. Public transport provides ferry as well as local light rail services which run every 7 minutes (3 stations in the estate) and within 5 minutes takes passengers to the main train station; and within 10-30 minutes reaches any part of Stockholm city centre.[202]

According to research, 52% of the residents of the Hammarby Sjöstad housing estate use public transport, 27% cycle or walk and only 21% travel by means of a car (table No. 5).

Table 5. Mode splits for journeys in various parts of Stockholm Country

Mode of transportation	Inner city	Western suburbs	Southern suburbs	Hammarby Sjöstad
Car	17	43	39	21
Public transit	36	23	28	52
Bike/walk	47	34	32	27

Source: Own elaboration based on: H. Suzuki, R. Cervero, K. Iuchi, *Transforming Cities with Transit. Transit and Land-Use Integration for Sustainable Urban Development*, Urban Development Series, The World Bank, Washington DC 2013, p. 60.

The briefly described and aforementioned examples differ from each other in many important issues such as:

[201] H. Suzuki, R. Cervero, K. Iuchi, *Transforming Cities with Transit. Transit and Land-Use Integration for Sustainable Urban Development*, Urban Development Series, The World Bank, Washington DC 2013, page 58.

[202] Ibid., page 58.

- geographical location – Europe (Copenhagen, Stockholm) and Asia (Singapore, Masdar City);
- financial conditions – both Copenhagen and Stockholm had significant financial constraints. This problem does not affect the Masdar City project which is funded by investors from the United Arab Emirates.
- climate and nature conditions – high temperature throughout the year (23°C-39°C) and large desert areas in case of Masdar City. However, in Copenhagen the temperature and weather conditions vary – (depending on the time of year) as well as the various terrain topography due to the city's location which is on the eastern shore of Zealand island;
- project's advancement – Copenhagen's Finger Plan has been implemented for more than 60 years and the project of Masdar City is only at the beginning stage of implementation;
- project's range:
  - The Copenhagen's Finger Plan – concerns city transport development in the already existing city;
  - Singapore's Constellation Plan – concerns transport development in the agglomeration of several cities;
  - Masdar City – concerns developing an emission-free city, without any waste production and supplied entirely with electric energy from renewable sources;
  - Hammarby Sjöstad in Stockholm – concerns revitalization of the city district in order to reduce its negative influence on the environment.

As we can see, each project had different assumptions but still in part or in whole was/is associated with planning and transport management in the city. In addition, (which is the most important from the point of view this paper) one of the main objectives of the listed 4 examples is: **to bring about a significant reduction in road transport, and as a result to eliminate congestions and reduce noise level, thus dramatically reducing the negative influence of road transport on the environment and promoting a healthy lifestyle of walking and cycling.**

Also, these examples show that it is not essential whether a project is designed for the entire city or for its district or maybe for a whole agglomeration or even for a newly established city. What is important is the vision and a plan based on a good idea which considers a number of factors (described above) that affect its success. The team that is responsible for its implementation and management is also very important.

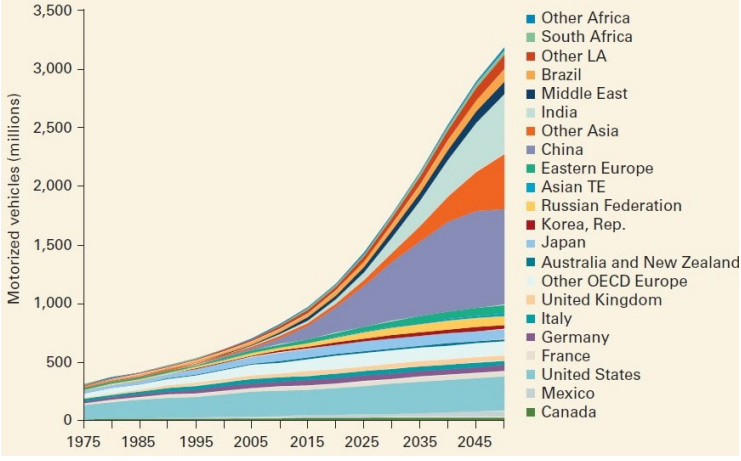
The role of the planners and urbanists responsible for the development of urban transport networks is very important. Their actions not only have an

influence on the described reduction of transport's influence on the environment but also enable social integration and have a significant meaning in the revival of districts and economic development. For example, traffic congestion in the UK is causing the government to loss US$36 billion each year by 2025.[203]

According to research, this situation in the coming years will not be improved but on the contrary, it will grow worse because the number of residents in large cities increases at an unprecedented rate. Their population will increase from 2.0 billion in 2000 to 5.5 billion in 2050, which is a 95% increase of urban population in the world.[204] We should be aware that with the increase of the number of residents the number of cars increases as well (figure No. 6.5), which will consequently lead to the deterioration of the situation on the roads.

Back in 2011, approximately 45% of the drivers travelling on Moscow streets and 35% in Nairobi when questioned replied that they spend at least three hours a day stuck in traffic jams. The study showed a number of side effects, including: stress, aggression and respiratory illnesses resulting from the inhalation of dirty air as well as numerous bumps and car accidents (sometimes fatal)[205].

Figure 6.5. Actual and projected number of motorised vehicles in the world, 1975-2050



Source: H. Suzuki, R. Cervero, K. Iuchi, *Transforming Cities with Transit. Transit and Land-Use Integration for Sustainable Urban Development*, Urban Development Series, The World Bank, Washington DC 2013, p. 30.

[203] R. Simpson, M. Zimmermann, *The Economy of Green Cities, A World Compendium on the Green Urban Economy*, Springer, London 2012, page 134.

[204] H. Suzuki, R. Cervero, K. Iuchi, *Transforming Cities with Transit. Transit and Land-Use Integration for Sustainable Urban Development*, Urban Development Series, The World Bank, Washington DC 2013, p. 3.

[205] Ibidem, page 30.

Another negative effect of the increase in the number of cars is the increase of energy consumption. According to research, there is a strong correlation between the density of buildings and population and energy consumption. On this basis it was concluded that cities with low building density have a higher number of cars and a higher energy consumption per resident than the cities with a high density. The reasons for this can be found in the fact that residents in cities with less building density due to the distance choose cars more often as means of transport.[206] This information is also very important from the perspective of city planning and urban transport.

Generally, the most effective way to move around the city is public transport. With this in mind many cities all over the world invested huge funds in public transport development projects based on the purchase of electrical railway networks and hybrid buses as well as the construction of bicycle paths. Unexpectedly, it turned out that due to these investments, the attractiveness of public transport increased which caused the residents to drastically reduce the use of passenger cars (often even selling them). It was also noticed that properly planned non-motorised transport mainly including the construction of bicycle paths and pavements as well as the usage of special streets on which driving cars is prohibited (introducing special zones like promenades becomes more trendy also in Poland) becomes an interesting and popular alternative to passenger cars. Cities like Curitiba (Brazil) and Bogota (Colombia) are excellent examples where the implementation of these solutions has also significantly reduced car traffic on streets and public spaces.[207]

The popularity of public transport also increased in the areas where cities have just started to develop. This is due to the fact of covering long distances and the related large travel costs as well as long-time of travel. Unfortunately, the rapid growth of public transport in urban areas is often limited and sometimes impossible because there is no investment areas designated for the public transport services.

A number of projects having a positive influence on urban transport development and **reduction of its negative influence on the environment** are described in this chapter. We should be aware, however, that not all of the plans and their implementation can be considered to be successful. There are no specific examples presented below but based on their analysis the major reasons for their failures an attempt has been made to identify the main reasons for their failure, which were:

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206 Ibid., page 32.

207 R. Simpson, M. Zimmermann, *The Economy of Green Cities, A World Compendium on the Green Urban Economy*, Springer, London 2012, page 290.

- underestimation of the investment costs;
- short-sightedness that produces implementation of projects which are only a short-term solution such as rebuilding of only one section of a traffic-jammed street;
- insufficient knowledge of the regulations and technical issues;
- national and international restrictions and regulations;
- administrative barriers,
- urban negligence;
- lack of consistency with planning instruments, implementation and management;
- lack of a common objective on a city level – different missions, budgets, management styles;
- no adequate coordination at a high level;

In present times cities, through transport development, should strive to improve public access to its more ecological forms. For this purpose it is necessary to create interesting alternatives or improvements promoting means of transport that are environmental friendly. A number of solutions described below (depending on the means of transport) are used by cities all over the world to encourage their residents to use eco-transport.

6.2.1. Passenger cars and lorries

The participation of cars in polluting the atmosphere is about 30% and up to 70-90% in large cities, thus cars are considered to be the most environmentally unfriendly mode of transport. As it is written in the introduction of this chapter "The CO_2 emission caused by cars is approximately five times greater than CO_2 pollution from busses, approximately five hundred times greater than a tram's emission and close to one thousand times more than a metro. Comparable differences in the poisoning of the environment by a car – in comparison to other means of transport – are in the case of hydrocarbons".[208] Remember, that road transport through the emission of lead, ozone and particulates can cause severe upper respiratory diseases and even damage organs in the long run.

It's no wonder that the most known green communication strategies in cities are focused primarily on reducing the number of cars and lorries travelling on their streets.

The first of many solutions used by cities are the previously described **"green zones"** or **Low Emission Zone**. A **Congestion Charge** which is to be paid for

[208] J. Zyśk, *Less energy, less emission [Mniej energii, mniej emisji]*, "Środowisko" 18/2009, No. 402, page 16.

entry into London is also a similar solution. This is a one-time fee of 8 Pounds. It's valid Monday through Friday from 7:00 AM to 6:30 PM. It was introduced in order to reduce traffic in the city centre, to reduce traffic congestion and the noise level. This initiative enabled the reduction of traffic and the negative influence of road transport on the environment at the same time.

The second solution used by cities to restrict car traffic is the introduction of **paid parking zones**. They are often expensive (a fee for some parking areas in Chicago is $6 per hour) and time restricted (in Chicago centre a car can be parked for a maximum of 2 hours). An obvious novelty is **also parking metres powered by solar energy** (photo No. 6.3).

Photo 6.3. A parking metre in Miami Beach

Source: Own elaboration.

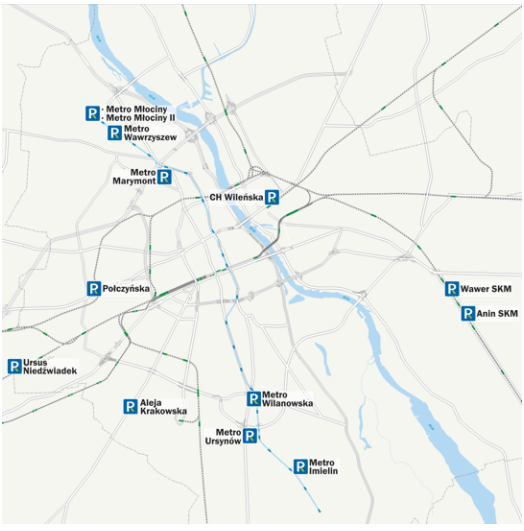
Another solution to reduce the negative influence of passenger cars and lorries on the natural environment is the introduction of the **Idling Reduction** principle of standing time limitation (on idle speed) of cars with diesel engines up to 3 minutes (photo No. 6.4). This principle does not only improve air quality but also leads to fuel savings.

Photo 6.4. Information sign of the Idling Reduction principle (Chicago)

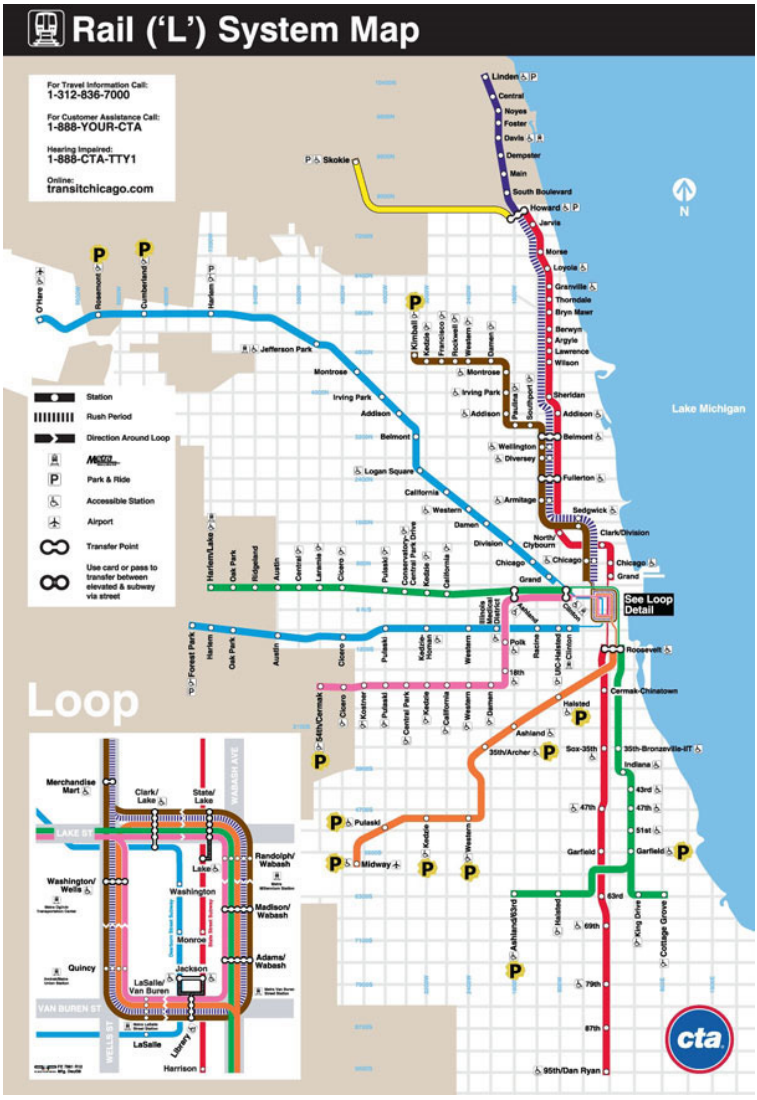
Source: Own elaboration.

The next idea to reduce traffic in the city centre and to promote public transport is **Park & ride** car parking lots. There are public parking lots, unguarded and located mostly in the city outskirts by the metro or rail station (figure No. 6.6). This is a good solution for people who live outside the city and want to reach their workplace in the city centre in a short time.

Figure 6.6. The Park&Ride system in Warsaw and Chicago



Park & Ride system in Warsaw



Chicago Park & Ride system

Source: Own elaboration based on: http://www.ztm.waw.pl/parkujijedz.php?c=116&l=2 (of 31.5.2014) and http://chicagoparking.spplus.com/Chicago-CTA-Parking.html (of 31.5.2014).

A well-known and widespread initiative in Poland as well aiming to reduce passenger car traffic in the centre and to make public transport flow smoother is the introduction of special lanes for buses and taxis called **bus lanes**. Also **High Occupancy Vehicle Lanes** were introduced in the United States reserved for any passenger vehicles carrying **at least two people**.

Electric and hybrid cars also have a very significant influence in improving the natural environment in urban areas. They are both economic and ecological. Additionally, in many countries of the European Union governments financially help with the purchase of this type of vehicle.

The main advantage of electric cars is the fact that they do not emit any exhaust gas into the atmosphere. But a disadvantage is their relatively low range, small engine power and the necessity of frequent battery charging (photo No. 5). Additionally, there is the lack of a proper infrastructure enabling travel around the country in this type of car in Poland at the present day. It should be also noted that although "an electric car does not emit any exhaust gas into the atmosphere, but the power needed to charge the batteries comes from power plants which emit gas during the production of the electricity. According to the calculations, the exhaust gas emission of the electric car calculated in this way is merely 1/3 of the average emission of combustion car engines".[209]

Photo 6.5. An electric car during charging

Source: http://autokult.pl/2012/07/29/doplaty-do-aut-hybrydowych-i-elektrycznych-w-polsce-trwaja-prace-nad-ustawa (of 1.6.2014).

Hybrid cars are now more popular than electric cars. The technology applied combines two different energy sources within a single vehicle. The combustion engine works together with the electric motor under this solution.[210]

[209] J. Zyśk, *Less energy, less emission [Mniej energii, mniej emisji]*, Środowisko 18/2009, No. 402, page 18.

[210] Ibid. page 18.

Owners of hybrid or electric cars may park their cars in paid parking zones at preferential prices or even for free in many Polish cities (e.g., Wrocław, Katowice, Toruń).

Cities should also run information campaigns about **ecodriving, which saves** fuel, reduces exhaust gas emission, reduces the noise level, relieves driving stress and reduces the risk of driving accidents.[211]

6.2.2. Buses

Buses are the most popular collective mode of transport in cities. It is due to a number of factors such as: the availability of the road infrastructure which is used by cars and lorries (usually there is no need for new road construction), relatively low price compared to the alternatives (metro, trams, trains), the short duration of the construction of a new communication line and the ability to reach any part of the city. These characteristics make buses still irreplaceable for passenger transport (especially in the smaller towns) although other means of collective transport (metro, trains or trams) are more environmental friendly, do not travel through jammed streets and are able to transport more people.

Many cities are now in the implementation phase of projects to reduce the number of motorbikes and cars travelling in city centres. These plans assume that the individual road traffic reduction will significantly reduce traffic congestions, reduce the noise level and reduce energy and fuel consumption (photo No. 6.6). The city buses, among others, are to help with the implementation of these objectives.

An example of such project is the "2015 Sustainable Chicago"[212] which the primary goal is to: increase the average daily number of public transport passengers and reduce fuel consumption in the city by 10%. As it results from the analyses carried out for the purpose of this project, one bus travelling through the city centre carries as many passengers as 23 cars (figure No. 6.7). With this in mind, urban transport managers in Chicago promote public bus transport in order to improve traffic in the city centre.

Nowadays, **hybrid buses** are the most popular in developed countries (photo No. 6.7). Their price is higher but their efficient fuel consumption and increased mileage (the lifetime of this type of bus is equal to 15-20 years) cause that the high price of a bus pays for itself after 6-7 years of service. The significant reduction of fuel consumption combined with better performance conditions of

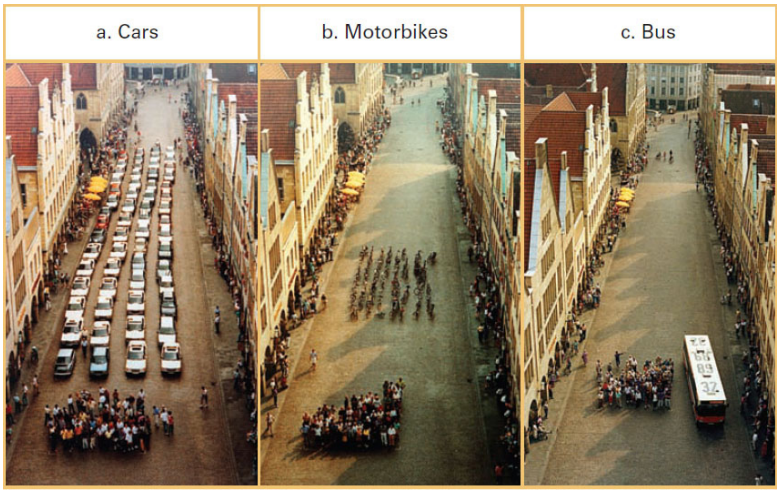
[211] Ibid. page 18.

[212] http://www.cityofchicago.org/city/en/progs/env/sustainable_chicago2015.html (of 1.6.2014).

the combustion engine brings savings of 15-30% (depending on the traffic conditions) and a reduction in the pollution level by[213]:

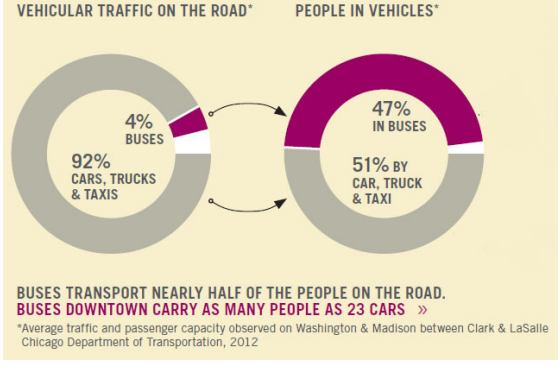
- 20-35% – less emission of carbon dioxide responsible for the greenhouse effect;
- 10-40% – less emission of nitrogen oxides;
- 50-97% – less emission of particulates (carcinogenic soot).

Photo 6.6. Urban space taken up by cars, motorbikes and buses



Source: H. Suzuki, R. Cervero, K. Iuchi, *Transforming Cities with Transit. Transit and Land-Use Integration for Sustainable Urban Development*, Urban Development Series, The World Bank, Washington DC 2013, p. 35.

Figure 6.7. Efficient transportation to reduce congestion



Source: 2015 Sustainable Chicago, p. 15.

[213] P. Wójcik, *Polish hybrid on foreign roads [Polska hybryda na niepolskich drogach]*, „Środowisko" 13/2008, No. 373, page 35.

Photo 6.7. Hybrid buses on the streets of the United States

Chicago

Miami

New York

Washington

Source: Own elaboration.

Through the use of hybrid buses passengers may feel more comfortable during the travel due to such things as less noise inside and outside the vehicle.

Buses travelling on US streets additionally reduce energy consumption through **the lack of the automatic door mechanism to open all the bus doors**. Only the driver's door opens automatically and when the passenger wants to open the middle or the rear door, he must press a specially marked button on that door.

Since 2010 there is a hydrogen fuel station in London (the first in Europe), belonging to the Transport for London company which supplies several **buses** with **hydrogen** fuel. Hydrogen buses were also tested (with a positive outcome) in Reykjavik (Iceland), Amsterdam (Holland) and Cologne (Germany).

The main advantage of this technology is the lack of exhaust gas emission. Additionally, the use of hydrogen as an energy source for road transport will reduce crude oil consumption (it is estimated that up to 40% by 2050 in this sector). While the disadvantages are: high price, lack of adequate infrastructure,

problems with storing hydrogen as well as a need of having a large tank and the necessity to determine the exact route.[214]

Another notable solution worthy of mention is the **Bus Rapid Transit (BRT)** which is an advanced bus system that creates special bus lanes on the city streets . At first glance, the idea seems to be very similar to the bus lanes idea but in fact, these two systems are completely different. The main difference is the BRT uses specially constructed station (photo No. 6.8) rather than traditional bus stops. The stations have a high platform level which is the same as the level of a bus floor so passengers can go on-board in a quick and easy manner. Additionally, prior to entering the station a fee must be paid which helps to eliminate passengers without tickets.

Photo 6.8. BRT station in Bangkok

Source: http://www.tour-bangkok-legacies.com/bangkok-brt.html

The BRT system was first used in the Brazilian city of Curitiba. Since then it is being successfully introduced to more cities around the world (currently this system is being implemented in cities like Chicago[215] and San Francisco). According to their experience, this system is a good alternative for passenger cars. In addition, it enables significant reductions of fuel and energy consumption.

The city of San Francisco, mentioned in the previous paragraph, is considered to be one of the most environmental friendly cities in the USA. The city uses a wide

[214] K. Forowicz, *They already tank hydrogen in London [W Londynie już tankują wodór]*, Środowisko 8/2011, No. 440, page 18.

[215] http://www.brtchicago.com/ (of 31.5.2014).

range of solutions that have a positive influence on reducing the negative impact on the environment. One of these solutions is the **"Seismic Wave" Transit Shelter** (photo No. 6.9). The shelters combine innovative solar technology with a design that is meant to evoke both a seismic wave and the hills of San Francisco. The wave-like red roof of the shelter is embedded with photo-voltaic cells that will power the LEDs and are expected to pump the excess electricity they generate back into the city's grid (up to 40% percent of all energy captured).[216]

Photo 6.9. "Seismic Wave" Transit Shelter in San Francisco

Source: Own elaboration based on http://www.dwell.com/travel-reports/article/san-franciscos-new-bus--shelters (of 1.6.2014).

6.2.3. Bicycles and walking

In relation to the previous subsection, the first example of promoting the cycling communication system is the "**free bus transfer for a cyclist**". The idea is that the person riding a bicycle can use a bus at any time without the obligation of a ticket purchase (in this case, the bicycle is mounted to the front of a bus). This allows for more people to switch to the bicycle transport because they do not need to be worry about the weather conditions.

A bicycle is the most environmental friendly mode of transport. In this respect cities every year **expand the cycling infrastructure** and invest in a city **bicycle rentals** (Photo No. 6.10 presents the Divvy system functioning in Chicago – it should be noted, that the device used to charge fees is powered by solar radiation).

[216] http://sf.streetsblog.org/2009/05/29/mayor-newsom-and-mta-cut-ribbon-on-new-solar-bus-shelters/ (of 31.5.2014).

Photo 6.10. Divvy bicycle rental system in Chicago

Source: own elaboration.

The most well-known and widely accepted bicycle rental system in Poland is Veturilo. It was started in August 2012 and now has 2650 modern bicycles in more than 170 stations in 14 Warsaw districts.[217] The first 20 minutes of using the Veturilo is free of charge. The next 40 minutes costs PLN 1 and the following hour costs PLN 3.

This system is very popular according to the analysis. Users consider the easy access to the bicycles and the affordable price to be its biggest advantages.

The next solution aimed at encouraging residents to use bicycles is various promotion **campaigns**. An example would be the **European Car-free Day** celebrated every year on September 22. This campaign encourages people to use bicycles instead of cars which as a result reduces road congestions, provides clean air and reduces the noise level.

Another idea is an innovative solution of **Bicimetro Eco Bahn: Elevated Bike Tunnels Let Cyclists Soar Above Congested City Traffic.** It involves the construction of bicycle lanes in tunnels located at a height of 10 meters. They will be made of glass and steel as well as they are to protect riders from hazards on the roads, they're topped with energy-generating wind turbines and photovoltaic panels. (figure No. 6.8).[218]

[217] http://www.veturilo.waw.pl/jak-to-dziala/ (of 1.6.2014).

[218] http://inhabitat.com/bicimetro-eco-bahn-lets-cyclists-soar-above-congested-city-traffic/

Figure 6.8. Bicimetro Eco Bahn: Elevated Bike Tunnels Let Cyclists Soar Above Congested City Traffic

Source: http://inhabitat.com/bicimetro-eco-bahn-lets-cyclists-soar-above-congested-city-traffic/

According to the studies carried out by the city of Chicago[219] there is an increased number of residents that walk around the city. This is the result of building new footpaths which are located close to the nature, they are properly marked and are well illuminated causing even a walk at night to be safe.

The city of Chicago uses the developed system: **complete streets guidelines create a safe convenient transportation system for all people** when creating new footpaths and bicycle paths. This system also applies to other forms of road transport.

The next example that has a positive influence on the growth of the number of people walking and cycling is Toronto. This city introduced the **Toronto Walking Strategy** which improves access to shops, services and jobs for people travelling around the city streets without a car. According to research in 2008, nearly 58% of the city's population walked to work in the city centre (an increase from 44% in 2001), at the same time the number of cyclists doubled, while the number of car users dropped to 6% (from 16%).[220]

[219] The Chicago Green Alley Handbook – An Action Guide to Create a Greener, Environmentally Sustainable Chicago.

[220] R. Simpson, M. Zimmermann, *The Economy of Green Cities, A World Compendium on the Green Urban Economy*, Springer, London 2012, page 199.

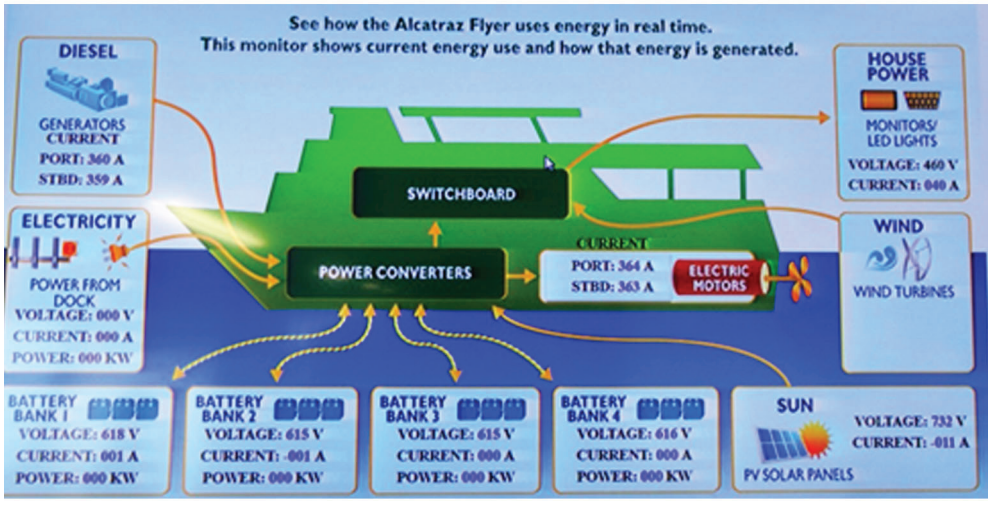
6.2.4. Ferries

Modern public means of transport are those that use nature as the additional energy source. An example here would be ferries in San Francisco using **solar energy** (photo No. 11A) and **wind energy** (photo No. 11B) for such things as lighting, monitoring and sound systems. Each passenger can watch on monitors placed on board the current energy consumption of the ferry as well as in what way and in what amount it is currently generated (photo No. 6.11C).

Photo 6.11. Passenger boat in San Francisco

11.A

11.B



11.C

Source: own elaboration.

Summary

Planning and transport management in eco cities (agglomerations and regions) should comprise the essential components of existing transport systems, including their actions to reduce the negative environmental impact of transport on the environment.

There are a number of examples listed in this chapter presenting instruments that enable a city to reduce the impact of transport on the environment. From their analysis it can be stated that a noticeable trend, which should be maintained in the coming years, is striving to:

- reduce the amount of passenger cars in city traffic while increasing the use of public transport, cycling and walking,
- implement technological developments enabling the use of modern solutions (e.g. vehicles) that are environmentally friendly,
- optimise organization and management in the city.

The use of the possibilities offered in environmental transport provides cities with the opportunity and tools not only to reduce the negative impact of transport on the environment, but also to effectively combat traffic congestion and noise.

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11. K. Forowicz, *They already tank hydrogen in London* [*W Londynie już tankują wodór*], Środowisko 8/2011, No. 440

Act and other regulations

1. Official Journal of the European Union C 83 of 30 March 2010.
2. Directive 2009/33/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of clean and energy-efficient road transport vehicles
3. Directive 2007/46/EC of the European Parliament and of the Council of 5 September 2007 establishing a framework for the approval of motor vehicles and their trailers and of systems, components and separate technical units intended for such vehicles.
4. Directive 2004/17/EC of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors,
5. Directive 2004/18/EC of 31 March 2004 on the coordination of procedures for the awarding of public works contracts, public supply contracts and public service contracts;
6. Decision No. 1600/2002/EC of the European Parliament and of the Council of 22 July 2002 laying down the Sixth Community Environment Action Programme;
7. The *Green Paper* of the European Commission of 25 September 2007 titled "Towards a new culture for urban mobility";
8. The resolution of the European Parliament of 22 October 2007 on the Community Strategy to reduce CO_2 emissions from passenger cars and light-commercial vehicles 2007/2119(INI).
9. "Clean power for transport" Directive – not published in the Official Journal.

WWW:

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Chapter 7

Energy efficiency – Planning and management in cities

Anna Stankowska

Preface

The data relating populations shows, that over 50 % of the population lives in municipal areas and this number grows every day. The reason for this situation is paid migration for a job and a better life. By 2025 there is expected a population growth of about 10 % in cities above 10 million of occupants. These numbers show a necessity of cities adaptation not only to new social requirements, but first of all to contact with natural environmental changes appearing with development of cities. These changes in colonization contribute to modifying people's behaviours, which means that some people will maintain contact with nature while others will stop it. Therefore, the main point of interest becomes the environment and connected with it the building process necessary for the development of civilization.

The progression of urbanization has meant that activities associated with the use of renewable resources and improvement of energy efficiency especially in the buildings sector on municipal areas, become the most important tools used in process of environment formation. Reconciliation of the activities carried out within the framework of the construction sector and environmental protection is not an easy process. This requires good cooperation between the authorities, investors, industry, and majority of all society. These activities are related because of aspects such as: social, legal, economic, and ecological.

The European countries have been firmly committed to the environment protection in the following areas:

- protection of air and water quality,
- conservation of resources and protection of biodiversity,
- waste management and control of activities./ its control

These areas which have an adverse environmental impact require commitment on an internal and international level. This is a reason why European environment policy aims to ensure the sustainable development of society.

One of the tools of protecting environment are common policies of European Union, national programmes and energy efficiency plans. It is the EU which answers to such issues as: a dramatic increase of energy consumption, climate change, the strain on energy resources and access for all users to affordable, secure energy.

In order to prevent the climate change the European Counsil is putting plans for 2020 to reduce greenhouse gas emission by 20%, increase the share of relevant energy to 20% and improve by 20% of energy efficiency. At the same time, EU has prepared the long – term strategy commitment to cut of 80-95% of emission by 2050 in industrialised countries.

> *"The energy sector faces far-reaching decisions at the European level, at national level, in the financial industry and the energy sector. And it is clear there is no sector of our society, which needs such long-term planning security as the energy sector. As I put it – 2020 was yesterday and 2030 is already at the door steps. It is therefore indispensable to create a stable and predictable regulatory framework for 2030 already today."*
>
> **Günther Oettinger** – European Commissioner for Energy[221]

Reduction of energy consumption in European buildings is one of the priority objectives on a journey to the low – emission future in cities. It has been estimated that almost 40 % of final energy consumption applies to buildings from the private and public sector. In consequence, reducing the final energy consumption will help to decelerate the climate changes taking place.

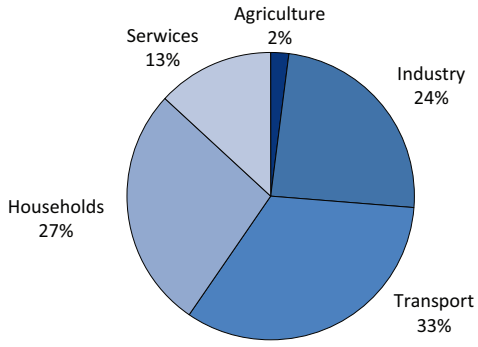
[221] http://www.erec2013.org/en/home_95.aspx

7.1. European policies and strategies about Energy Efficiency

7.1.1. Introduction

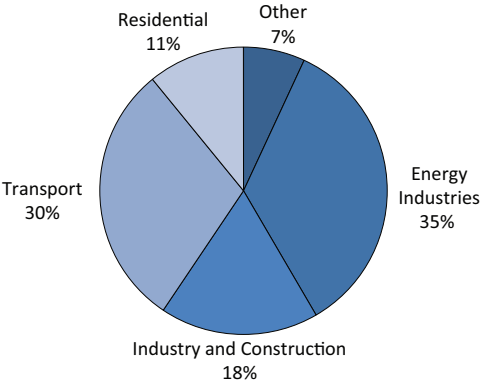
Reducing by about 20 % energy consumption in European Union concerns a few sectors of economy in cities, of which one is the building sector. This sector has the greatest potential for savings of energy consumption. Besides this, the greenhouse gas emission coming from the building sector must be reduced by 88% to 91% by 2050[222]. In order to reduce buildings' impact on the natural environment, the EU has prepared the strategies, directives and regulations as tools to achieve these goals. The final energy consumption by sector and greenhouse gas emission is shown in Figure 7.1-7.3.

Figure 7.1. Final energy consumption in EU by sector in 2009



Source: http://ec.europa.eu/energy/observatory/countries/doc/key_figures.pdf

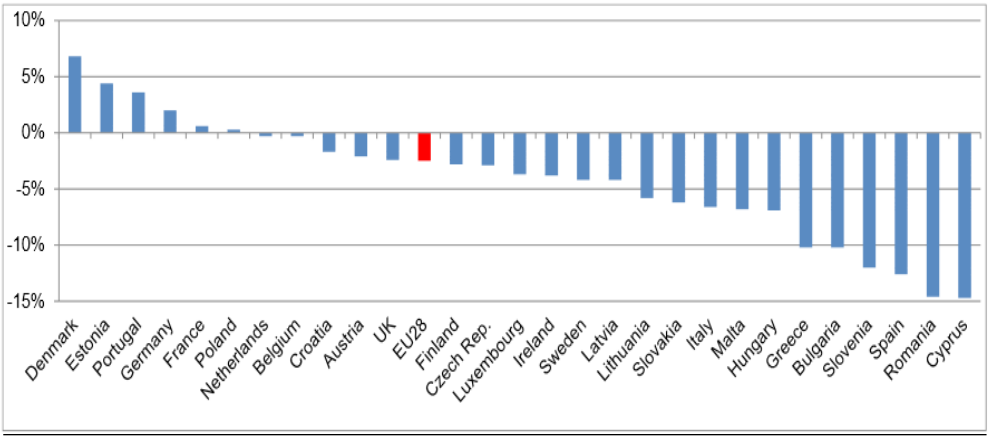
Figure 7.2. Greenhouse gas emission in EU by sector in 2009



Source: http://ec.europa.eu/energy/observatory/countries/doc/key_figures.pdf

[222] COM(2011) 112 – a roadmap for moving to a competitive low carbon economy in 2050.

Figure 7.3. Change in CO_2 emissions, 2012/2013 in European Union



Source: Eurostat, 72/2014, 7 May 2014.

7.1.2. Documents related to buildings

Main documents related to buildings include the following:

1. Communication "A policy framework for climate and energy in the period from 2020 to 2030"[223],
2. Green Paper "A 2030 framework for climate and energy policies"[224],
3. Energy Roadmap 2050[225],
4. Roadmap for moving to a competitive low-carbon economy in 2050[226].

1. Communication "A policy framework for climate and energy in the period from 2020 to 2030"[227]

This document shows the framework for climate and energy in the period from 2020 to 2030. The first step of energy and climate policies concerns three targets (20/20/20 targets): greenhouse gas emissions reductions, renewable energy and energy savings. This is the next step which will help stop climate changes.

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[223] Communication "A policy framework for climate and energy in the period from 2020 to 2030" COM (2014) 15 http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52014DC0015

[224] **GREEN PAPER A 2030 framework for climate and energy policies (COM/2013/0169 final)** http://ec.europa.eu/energy/consultations/20130702_green_paper_2030_en.htm

[225] Energy Roadmap 2050, Brussels, 15.12.2011 COM (2011) 885 final, http://ec.europa.eu/energy/energy2020/roadmap/index_en.htm

[226] Roadmap for moving to a competitive low-carbon economy in 2050. Brussels, 8.3.2011 COM (2011) 112 final: http://ec.europa.eu/clima/policies/roadmap/index_en.htm

[227] http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52014DC0015

The key achievements of the current energy and climate policy in the UE are to be attained by 2020 and concern the following areas[228]:

- "*Greenhouse gas emissions in 2012 decreased by 18% relative to emissions in 1990 and are expected to reduce further to levels: 24% and 32% lower than in 1990 by 2020 and 2030 respectively on the basis of current policies.*
- *The share of renewable energy increased to 13% in 2012 as a proportion of final energy consumed and is expected to rise further to 21% in 2020 and 24% in 2030.*
- *The EU had installed about 44% of the world's renewable electricity (excluding hydro) at the end of 2012.*
- *The energy intensity of the EU economy reduced by 24% between 1995 and 2011 whilst the improvement by industry was about 30%.*
- *The carbon intensity of the EU economy fell by 28% between 1995 and 2010".*

European Commission proposes three new targets for 2030:

- Reduction to 40 % of greenhouse gas emission in 2030 as compared to 1990,
- Increase in the share of renewable energy in the electricity sector to 45% in 2013 as compared to 1990,
- Increase to 40 % of energy efficiency in 2030 as compared to 1990.

These targets for 2030 will be reviewed by the end of 2014. The European Commission expects that by the end of 2014 it will have agreed with the Council and the European Parliament the final shape of these targets.

2. Green Paper[229]

Green Paper reflects a need to develop a new 2030 framework for climate and energy policy. This document also refers to the aims contained in Roadmaps for 2050. The aim of this document is to consult with stakeholders in order to obtain evidence and knowledge that contributes to the creation of a framework for the period 2030. In Energy Roadmap 2050[230] it is stated that electricity sector plays a key role in damming climate changes, in this document there is also emphasised the quantity share of electricity used in buildings as compared to the overall use of energy. It is expected that electricity will double its share in final energy demand to 36-39% in 2050.

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228 Communication "A policy framework for climate and energy in the period from 2020 to 2030" COM (2014) 15 final, Brussels, 22.1.2014.

229 **Green Paper 2030 framework for climate and energy policies (COM/2013/0169 final)** http://ec.europa.eu/energy/consultations/20130702_green_paper_2030_en.htm

230 Energy Roadmap 2050 (COM (2011) 885 final).

3. Energy Roadmap 2050[231]

Communication "Energy Roadmap 2050" was adopted by the European Commission on 15 December 2011. This document is the basis for developing a long-term European framework and sets out the most cost-efficient pathway to reach the target of reducing greenhouse gas emissions by 80% – 95 % by 2050.

4. Roadmap for moving to a competitive low-carbon economy in 2050[232]

The roadmap was adopted on March 8th, 2011. The European Commission has identified ways to reduce greenhouse gas emissions from 80 to 95 % by 2050. The plan indicates that the achievement of this goal by 2020 would require a 40 % reduction in greenhouse gas (GHG) emissions in 2030 and 80 % in 2050 compared to 1990. It requires that all Member States should develop national low-carbon Roadmaps, if not even have action plans made. The Commission provides some of the necessary tools and policies. The EU confirms that the existing policies of the Member States will achieve the target of 20 % reduction of greenhouse gas emissions in the country by 2020. In this Communication, the EU does not set new targets for 2020.

In this plan there are also included the ranges of emission reductions for 2030 and 2050 for key sectors of the economy. The Commission intends to use an action plan as the basis to develop specific policy initiatives and action plans in the sector, such as the 2050 Energy Roadmap and the upcoming White Paper on transport.

7.1.3. Policy orientation to 2020 related to buildings

Main policy orientations to 2020 include the following documents[233]:

1. Energy efficiency for the 2020 goal[234]
2. Energy efficiency plan 2011 (EEP)
3. The Global Energy Efficiency and Renewable Energy Fund[235]
4. Green Paper on energy efficiency

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231 Energy Roadmap 2050, Brussels, 15.12.2011 COM (2011) 885 final.

232 Roadmap for moving to a competitive low-carbon economy in 2050. Brussels, 8.3.2011 COM (2011) 112 final: http://ec.europa.eu/clima/policies/roadmap/index_en.htm

233 http://europa.eu/legislation_summaries/energy/energy_efficiency/index_pl.htm

234 Energy efficient means the ratio of the results obtained, services, goods or energy, energy input.

235 http://europa.eu/legislation_summaries/energy/energy_efficiency/l27063_en.htm

1. Energy efficiency for the 2020 goal

- ACT: Communication from the Commission of 13 November 2008 – Energy efficiency: delivering the 20% target[236].

This document includes the main information about **energy efficiency in the building sector**. Actions to improve energy efficiency in order to:

- prevent climate change,
- improve energy security,
- achieve the Lisbon objectives,
- reduce costs within the European Union.

In this document there are proposed various measures to improve energy efficiency. Measuring energy efficiency in the building sector relates to the fact that energy consumption in residential and commercial buildings accounts for approximately 40 % of total final energy consumption. This constitutes 36 % of total CO_2 emissions in the European Union.

This document contains information about measures for energy efficiency:

- **in the building sector.** European Commission calls for action to simplify the Directive 2002/91/EC on the energy performance of buildings. The EU proposes 1,000 m^2 threshold for existing buildings when their total renovation.
- **of products.** The EU has presented a Proposal for a Directive establishing a framework for the setting of ecodesign requirements for energy related products whose goal is to extend the scope of the Ecodesign Directive.

2. Energy efficiency plan 2011 (EEP)[237]

- ACT: Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions of 8 March 2011 – Energy Efficiency Plan 2011 [COM(2011) 109 final – Not published in the Official Journal].

This Plan sets fundamental directions for development of the European Union's Member States (EU) 2020. Reducing by about 20 % energy consumption in European Union is focused on a few sectors of economy in cities, one of these

[236] COM(2008) 772 – Not published in the Official Journal

[237] Communication "Energy Efficiency Plan 2011" [COM/2011/0109], http://europa.eu/legislation_summaries/energy/energy_efficiency/en0029_en.htm

is the building sector. In order to achieve the objectives of promoting efficient economy, low carbon system, increase the energy supply independence of the EU and strengthen the security of electricity supply, the European.

Commission proposes to act at different levels:

- **fostering low energy consumption in the construction sector**,
- developing competitive European industry,
- adapting national and European financing,
- making savings for the consumer,
- improving transport efficiency,
- widening the scope of the national framework.

In order to achieve low energy consumption in the construction sector, this plan emphasises the need to implement appropriate tools for reducing final energy consumption in buildings and improve the energy performance of buildings. This is important, because this sector is responsible for about 40 % of the final energy consumption in Europe.

It also emphasises the necessity to implement an adequate training of architects, engineers and technicians, e.g. "Agenda for new skills and jobs". Such training will effectively promote low energy consumption in the building sector.

This plan also contains some new action such as the necessity to implement:

- exemplary role of the public sector, accelerate the refurbishment rate of the building stock,
- accelerating the modernization rate of the building,
- public authorities should be required to modernize at least 3% of their buildings per year,
- introducing to public procurement the criteria of energy efficiency,
- improving the efficiency of power and heat generation.

3. The Global Energy Efficiency and Renewable Energy Fund[238].

- ACT: Communication from the Commission to the Council and the European Parliament of 6 October 2006: "Mobilising public and private finance towards global access to climate-friendly, affordable and secure energy services: The Global Energy Efficiency and Renewable Energy Fund".[239]

This document contains information about public-private partnership (GEEREF). The establishment of public-private partnership will share the risk

[238] http://europa.eu/legislation_summaries/energy/energy_efficiency/l27063_en.htm

[239] [COM(2006) 583 final – Not published in the Official Journal].

between the public partner and the private sector. This will also ensure the co-financing of investment projects in renewable energy and energy efficiency.

These projects will be aimed at increasing "patient" risk capital. This means that the capital invested in the long term returns on investments. GEEREF participation will be between 25 and 50% for investments in medium – and high-risk operations and 15% for investments in low-risk operations.

Projects in public – private partnership will enable the creation and funding of regional funds or scaling up similar existing initiatives. There will be no need for direct financing of projects. The Sub-Funds will accommodate the specific conditions and needs of each region.

4. Green Paper on energy efficiency

- ACT: Commission Green Paper, 22 June 2005, "Energy Efficiency – or Doing More With Less"[240]

In this document, the European Commission estimate that the EU could reduce energy consumption by 20% by 2020, which would bring annual savings of 60 billion euros per year. These savings will allow the realization of other investments.

These savings will also enable the strengthening of the competitiveness of European industry under the Lisbon strategy and could lead to the creation of millions of new jobs in transportation management, technology, high efficiency, etc. In addition, energy savings of 20% would also meet the commitments of the European Union (Tokyo commitments), through the reduction of CO_2 emissions.

The main directive promoting the energy performance of buildings and union of buildings – derogation from the act:

- **Directive 2009/28/EC on the promotion of the use of energy from renewable sources – 23 April 2009,**
- **Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings,**
- **COMMISSION DELEGATED REGULATION (EU) No 244/2012 of 16 January 2012 supplementing Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings by establishing a comparative methodology framework for calculating cost-optimal levels of minimum energy performance**

[240] [COM(2005) 265 final – not published in the Official Journal, http://europa.eu/legislation_summaries/energy/energy_efficiency/l27061_en.htm

requirements for buildings and building elements (Text with EEA relevance)[241]**,**

- ACT: Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC[242].

7.1.4. Main document about energy efficiency in buildings

The main document contains information about energy efficiency in buildings:

1. Energy performance of buildings[243],
2. Energy end-use efficiency and energy services,
3. Cogeneration.

1. Energy performance of buildings[244]

- ACT: Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings.[245]

The main objective of this Directive are:

- from December 31, 2020, all new buildings must meet the requirements of almost zero energy consumption.
- new buildings belonging to public authorities and which are their property should meet the same criteria after 31 December 2018
- European Commission calls for increasing the number of buildings of this type through the introduction of national plans, which include:
- description of how the Member States shall apply the definition of nearly zero energy,
- intermediate objectives, which are to improve the energy performance of new buildings by 2015,
- information related to the policies and financial resources adopted to encourage the improvement of the energy performance of buildings.

This Directive aims to promote the energy performance of buildings, parts or building units. Under provisions of the Directive, Member States are committed

241 http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32012R0244&from=EN#ntr1-L_2012081EN.01001801-E0001

242 http://europa.eu/legislation_summaries/energy/energy_efficiency/l27057_en.htm

243 (http://europa.eu/legislation_summaries/energy/energy_efficiency/en0021_en.htm)

244 (http://europa.eu/legislation_summaries/energy/energy_efficiency/en0021_en.htm)

245 This Directive repeals Directive 2002/91/EC.

to introduce on a national or regional level, the methodology for calculating the energy performance of buildings. This methodology should include the following elements:

- thermal characteristics of the building,
- equipment heating and hot water supply,
- air-conditioning systems,
- integrated lighting system,
- indoor climate conditions.

Setting minimum requirements for new buildings and existing buildings included in the Directive

Member States are required to implement the minimum energy performance requirements in order to achieve the optimal level of costs. The level of these requirements is updated every five years. The minimum requirements for the energy characteristics of buildings can be different depending on whether they are new buildings or existing buildings and depend on the category of buildings. In the case of **new buildings** the requirements of this Directive should be respected. Therefore, even before they are built, there should be made a feasibility study on the installation of systems to supply renewable energy, heat pumps, municipal or packaged heating and cooling systems and cogeneration systems. In the case of **existing buildings**, care should be taken to improve the energy performance so that they meet the minimum requirements.

The provisions of the Directive contain an exemption for some types of buildings from the application of the minimum requirements contained in this Directive, for example:

- buildings officially protected (for example, historical buildings),
- buildings used as places of worship,
- temporary buildings,
- residential buildings used for a limited time during the year,
- detached buildings with a total floor area of less than 50 m2.

Energy performance certificates

Member States should introduce a system of the energy performance certification of buildings. These certificates shall contain information about the energy consumption of buildings and recommendations in the area of cost reduction. In accordance with the requirements of the Directive, each building in the stage of construction, sale or rent must have an energy characteristics certificate. This certificate must be transferred to a new tenant or shown to a potential buyer, and then transferred.

In case of buildings in which the total area of over 500 m^2 is in the ownership of a public authority, and the buildings in which a total area of over 500 m^2 is frequently visited by the public, the energy performance certificate should be put in a prominent place clearly visible to the public (Figure 7.4). This limit will be reduced to 250 m^2 from 9 July 2015. States are required to implement a system of regular inspection of heating and air conditioning of buildings.

Figure 7.4. Energy performance certificate in public buildings – example

Source: http://www.emsd.gov.hk/emsd/eng/pee/eersb.shtml (21.05.2014).

1. Energy end-use efficiency and energy services

- ACT: Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC[246]

The main objective of this Directive

The purpose of this Directive is the cost-effective improvement of the end-use efficiency in the Member State. According to Article 1 of this Directive, this goal should be achieved by:

[246] http://europa.eu/legislation_summaries/energy/energy_efficiency/l27057_en.htm

- determining the targets which may be achieved by the mechanisms created within the European Union, incentives and institutional, financial and legal frameworks to remove existing market barriers and imperfections that impede the efficient end-use of energy,
- creating the conditions for the development and promotion of a market for energy services, and for the delivery to end-users of other energy efficiency improvement measures.

The general objective of energy savings

Member States shall adopt and aim to achieve the energy savings of 9% in the ninth year of application of this Directive. This should be achieved by energy services and other energy efficiency improvement measures. Member States shall take cost-effective, feasible and reasonable measures designed to achieve this goal.

Information about purchasing policy of the public sector

Member States must ensure that the public sector is taking steps to:

- improve energy efficiency,
- inform the public and businesses about the measures adopted,
- promote the good practices.

In addition to that, Annex VI to Directive includes measures that can be adopted in the public sector, such as:

- use of financial instruments for energy savings,
- the purchase of energy-efficient appliances and equipment;
- the purchase of energy-efficient products.

In addition, the Directive obliges Member States to designate one or more new or existing organizations to perform tasks of administration, management and implementation in order to meet its obligations.

2. Cogeneration

- ACT: Directive 2004/8/EC of the European Parliament and of the Council of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market and amending Directive 92/42/EEC[247]

[247] eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009R0219:EN:NOT

This document refers to the promotion of cogeneration. It is assumed that the cogeneration of electricity / heat can reach the energy efficiency of about 90%. Such systems can contribute to the reduction of approximately 250 million tons of greenhouse gas emissions in 2020.

The aim of this Directive is to establish a transparent common framework to promote and facilitate the installation of power plants. This overall objective has two specific objectives:

- to allow for a short period to consolidate the existing cogeneration plant and promote new plants;
- in the medium and long term, to create appropriate framework for cogeneration to make it possible to reduce CO_2 and other substances and to contribute to sustainable development.

Related Acts:

1. **Directive:**
   - **Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings [Official Journal L 153 of 18.6.2010].**
   - **Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market[248] [Official Journal L 283 of 27.10.2001].**
   - **Council Directive 92/42/EEC of 21 May 1992 on efficiency requirements for new hot-water boilers fired with liquid or gaseous fuels [Official Journal L 167 of 22.6.1992][249].**

2. **Decisions:**
   - **Commission Decision 2007/74/EC of 21 December 2006 establishing harmonised efficiency reference values for separate production of electricity and heat in application of Directive 2004/8/EC of the European Parliament and of the Council [Official Journal L 32 of 6 February 2007].**
   - **Commission Decision 2008/952/EC of 19 November 2008, establishing detailed guidelines for the implementation and application of Annex II to Directive 2004/8/EC of the European Parliament and of the Council [Official Journal L 338 of 17 December 2008].**

[248] http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32001L0077

[249] http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A31992L0042

7.1.5. Definition

Main definition contained in Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 *on the energy performance of buildings*, as follows:

- According to article 2.1. "'*building' means a roofed construction having walls, for which energy is used to condition the indoor climate"*;
- According to article 2.2: ***"'nearly zero-energy building'** means a building that has a very high energy performance, as determined in accordance with Annex I. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby;"*
- According to article 2.3."'*technical building system' means technical equipment for the heating, cooling, ventilation, hot water, lighting or for a combination thereof, of a building or building unit;*"
- According to article 2.4."'*energy performance of a building' means the calculated or measured amount of energy needed to meet the energy demand associated with a typical use of the building, which includes, inter alia, energy used for heating, cooling, ventilation, hot water and lighting"*;
- According to article 2.5. *"'primary energy' means energy from renewable and non-renewable sources which has not undergone any conversion or transformation process"*;
- According to article 2.6. *"'energy from renewable sources' means energy from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases"*;
- According to article 2.7. *"'building envelope' means the integrated elements of a building which separate its interior from the outdoor environment"*;
- According to article 2.8. *"'building unit' means a section, floor or apartment within a building which is designed or altered to be used separately"*;
- According to article 2.9. *"'building element' means a technical building system or an element of the building envelope"*;
- According to article 2.10. *'major renovation' means the renovation of a building where:*
  a. *the total cost of the renovation relating to the building envelope or the technical building systems is higher than 25% of the value of the building, excluding the value of the land upon which the building is situated; or*
  b. *(b)more than 25% of the surface of the building envelope undergoes renovation; Member States may choose to apply option (a) or (b)"*;

- According to article 2.11. *"'European standard' means a standard adopted by the European Committee for Standardisation, the European Committee for Electrotechnical Standardisation or the European Telecommunications Standards Institute and made available for public use*";
- According to article 2.12. *"'energy performance certificate' means a certificate recognised by a Member State or by a legal person designated by it, which indicates the energy performance of a building or building unit, calculated according to a methodology adopted in accordance with Article 3"*;
- According to article 2.13. *"'cogeneration' means simultaneous generation in one process of thermal energy and electrical and/or mechanical energy"*;
- According to article 2.14. *"'cost-optimal level' means the energy performance level which leads to the lowest cost during the estimated economic lifecycle, where:*
  a. the lowest cost is determined taking into account energy-related investment costs, maintenance and operating costs (including energy costs and savings, the category of building concerned, earnings from energy produced), where applicable, and disposal costs, where applicable; and
  b. the estimated economic lifecycle is determined by each Member State. It refers to the remaining estimated economic lifecycle of a building where energy performance requirements are set for the building as a whole, or to the estimated economic lifecycle of a building element where energy performance requirements are set for building elements.

The cost-optimal level shall lie within the range of performance levels where the cost benefit analysis calculated over the estimated economic lifecycle is positive";

7.1.6. Other documents about energy efficiency in buildings[250]

1. Technical Guidance „Financing the energy renovation of buildings with Cohesion Policy Funding"[251]

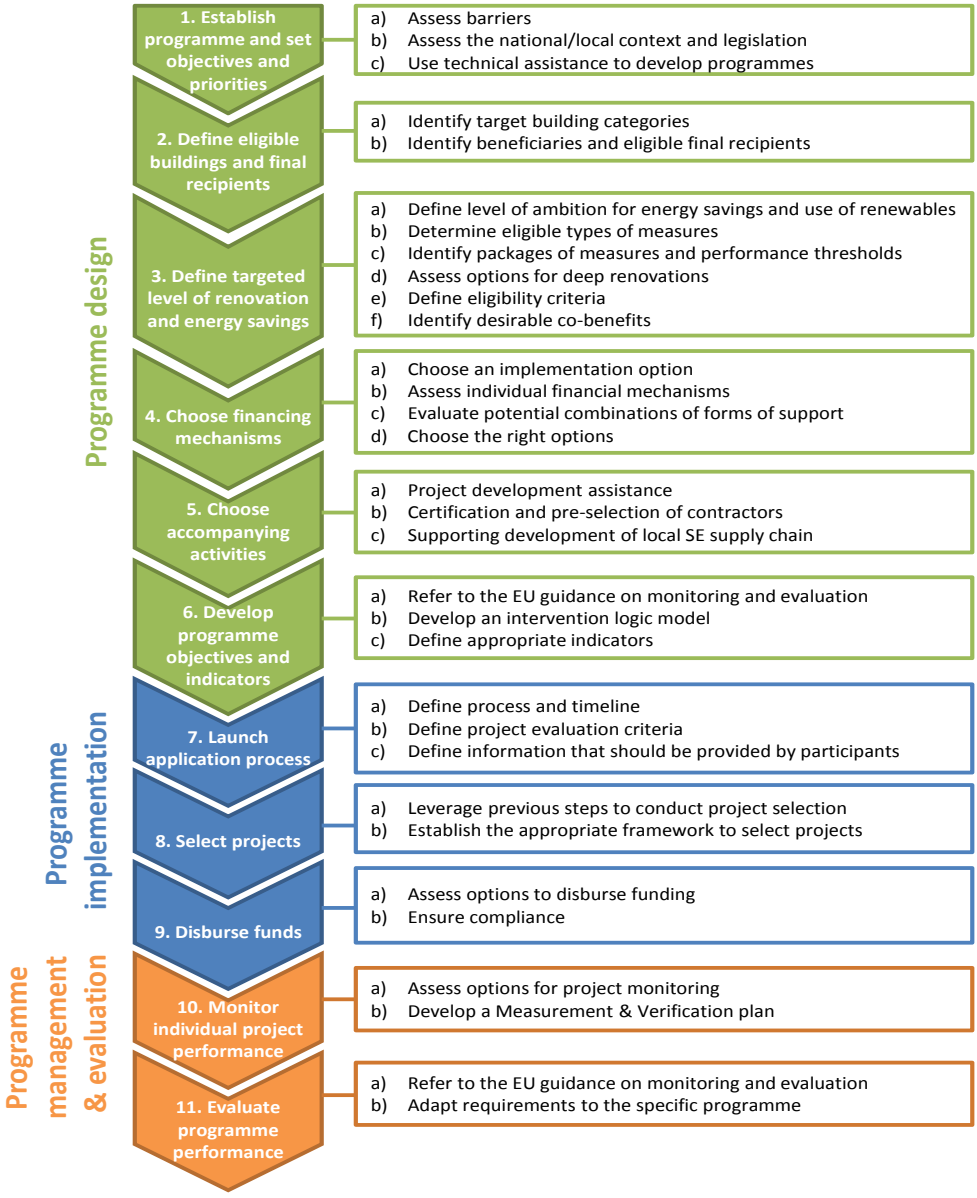
This report shows a list of good practice approaches and case studies about buildings and energy efficiency. The information contained in this document may be helpful for Managing Authorities to choose the optimal financing

[250] http://ec.europa.eu/energy/efficiency/buildings/buildings_en.htm

[251] http://ec.europa.eu/energy/efficiency/studies/doc/2014_guidance_energy_renovation_buildings.pdf

mechanisms for the implementation of the sustainable energy projects within the Operational Programme. The process of choosing optimal programme for financing the energy renovation of buildings, step by step is shown in Figure 7.5.

Figure 7.5. The process of selecting sources of financing investments in energy



Source: http://ec.europa.eu/energy/efficiency/studies/doc/2014_guidance_energy_renovation_buildings.pdf

This process consists of three main practical steps: **programme design, programme implementation** and **programme management and evaluation.**

The first step allows to identify the main barriers to the implementation of the investment, to select an appropriate financing instrument and programme, determine a budget and define indicators.

The next step concerns the implementation of the project, a timetable of mile stones and criteria for project evaluation and assessment of the options to disburse funding.

The third step concerns the choice of project monitoring, measurement and verification. The information collected is transmitted to the EU.

2. Report from the Commission to the European Parliament and Council. Financial support for energy efficiency in buildings[252]

In this report there are shown and explained two approaches concerning the calculating methods of the Energy Efficiency Investment Potential for the buildings. Both methodologies are based on the Fraunhofer Institute & Partners (2009)[253]. These methods are used to determine the potential energy savings. The difference between the methods concerns the definition of the building. In the first method there are taken into account only the existing buildings – EFC study on energy saving policies (Wesselink et al., 2010)[254]. The second method takes into account both existing buildings and new buildings (the Buildings Performance Institute Europe (BPIE)[255].

3. Delegated Regulation (EU) No 244/2012 of 16 January 2012 supplementing Directive 2010/31/EU on the energy performance of buildings by establishing a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements

The Delegated Regulation (EU) No 244/2012 supplementing Directive 2010/31/EU on the energy performance of buildings was adopted on 16 January 2012 by the European Union. This document shows a comparative methodology framework for calculating cost-optimal levels of minimum energy

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252 Report from the Commission to the European Parliament and Council. Financial support for energy efficiency in buildings. COM(2013) 225 final, Brussels, 18.4.2013

253 W. Eichhammer, T. Fleiter, B. Schlomann, S. Faberi, M. Fioretto, N. Piccioni, S. Lechtenböhmer, A. Schüring, G. Resch, *Study on the Energy Savings Potentials in EU Member States*, Candidate Countries and EEA Countries, 2009.

254 TREN/D1/239, 2006/S07.66640, Karlsruhe, 2009. Wesselink, B., R. Harmsen and W. Eichhammer (2010): Energy Savings 2020. How to triple the impact of energy saving policies in Europe. Report to the European Climate Foundation (ECF).

255 http://www.bpie.eu/eu_buildings_under_microscope.html

performance requirements for buildings and building elements. According to article 3. Comparative methodology framework, Member States shall apply the methodology for the calculation of cost-optimal levels of minimum energy performance requirements for buildings and building elements laid down in Annex I to this Regulation.

7.2. Energy efficiency in Poland – building sectors

7.2.1. Introduction

Despite the fact that there are directives on the energy performance of buildings, namely the Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002, it was necessary to intensify efforts in this area. In March 2007, the European Council calls on Member States, including Poland for careful and rapid implementation of the priorities set out in the Commission Communication, entitled "Action Plan for Energy Efficiency: Realising the Potential". The result was the development of the amendment of the Directive, the Directive of the European Parliament and of the Council 2010/31/EU of 19 May 2010 on the energy performance of buildings, the aim of which is to ensure the long-term process of improving the energy performance of buildings, and thus the entire construction sector. The provisions of the amended Directive 2010/31/EU on the defining trends in the promotion of low-carbon construction, have committed Poland to introduce many changes in the legislation, including:

- the definition of a "nearly zero-energy" building,
- the definition of a "level of cost-optimal",
- compulsory recognition and consideration of renewable energy in the newly designed buildings,
- from 1 January 2019 to strengthen the provisions for new public buildings and to other buildings from 1 January 2021 so as to be practically zero emissions, etc.

As a result, the National Fund for Environmental Protection and Water Management (NFEP&WM) from 2013 onwards began to implement the priority program entitled, "Efficient use of energy"[256], whose goal is to prepare investors, designers and manufacturers of building materials and contractors to the requirements of the Directive 2010/31/EU of 19 May 2010.

[256] http://www.nfosigw.gov.pl/en/

The eco solutions in urban policies planning and management in Poland are a growing industry. This approach shows economic solutions enabling improvement of the planning and management processes in eco cities, in the sphere of planning of strategic policy concerning leading a healthy lifestyle at the national level. The difficulties in providing economic and policy relevant information about sustainable economic planning and management of natural capital in cities are often seen as an important reason for inadequate integration of the environment in macroeconomic and sector polices. It is a major challenge for the world today.

Energy efficiency is considered to be a key component of the energy policy in Poland, and progress in this area will be necessary to achieve all of its objectives. Therefore, all possible measures will have to be taken to contribute to an increase in energy efficiency. Energy efficiency is important to ensure sustainable development and security of energy supply and also to increase the competitiveness of Poland for business and prosperity of society. The Polish government aims to achieve the energy savings following the economic terms that are cost-effective. Energy efficiency is an economically attractive means of contributing to the reduction of CO_2 emissions.

7.2.2. Regulation and main documents about green building sectors

Poland, as an EU Member State, is obliged to harmonise law with the EU requirements concerning energy performance of buildings directive. The legal framework for energy efficiency and energy performance in the buildings sector in Poland is defined by four main documents – national level:

1. Polish Energy Policy until 2030,
2. The National Energy Efficiency Action Plan (NEEAP),
3. National Renewable Energy Action Plans,
4. **National Programme for the Development of Low-Carbon Economy (NPRGN)[257].**

The obligation and the way of implementation of plans and policies presented on a county and regional/municipal level is determined by the document:

5. Assumptions of National Regional Development Strategy 2010-2020. Regions, cities, rural areas[258] (pl.: Krajowa Strategia Rozwoju Regionalnego 2010-2020. Regiony, miasta, obszary wiejskie.).

[257] http://www.mg.gov.pl/Bezpieczenstwo+gospodarcze/Gospodarka+niskoemisyjna/Narodowy+Program+Rozwoju+Gospodarki+Niskoemisyjnej

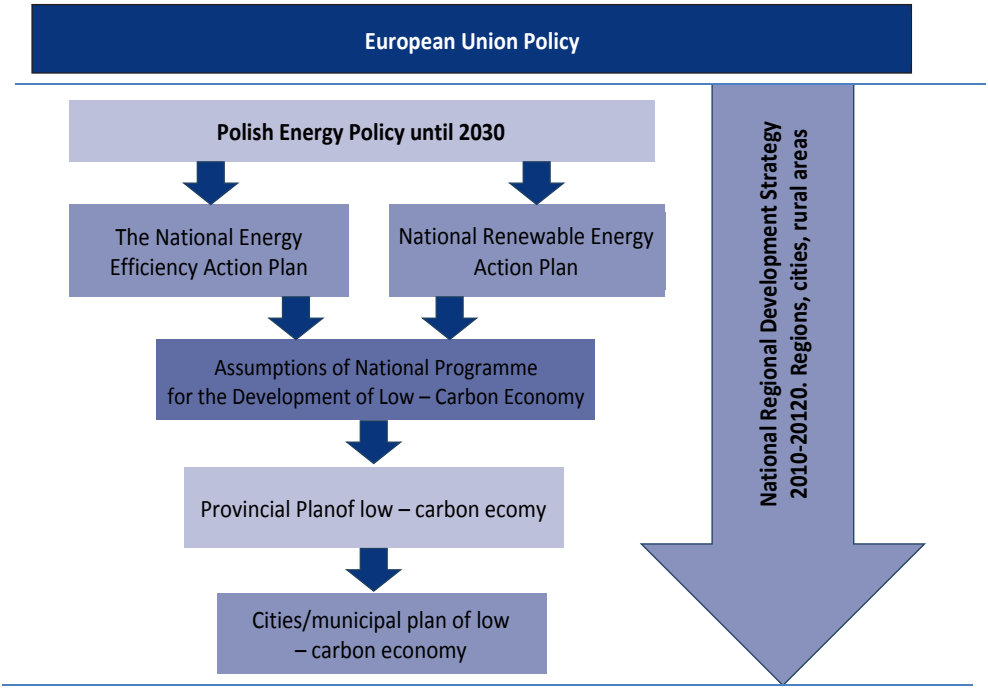
[258] National Regional Development Strategy 2010-2020. Regions, cities, rural areas, Warsaw, 13 July 2013 (http://www.mir.gov.pl/aktualnosci/polityka_rozwoju/documents/ksrr_13_07_2010.pdf).

The main regulation connected with both documents:

- Act of 10 April 1997 *on energy law*[259],
- Act of 21 November 2008 on supporting modernization and repairs[260],
- **Act of 15 April 2022 on energy efficiency**[261]**,**
- Act of 27 March 2003 on spatial planning and development,
- Act of 27 April 2001, the environmental protection law,
- Act of 7 July 1994, the building law,
- Act of 17 July 2009 on the system to manage the emissions of greenhouse gases and other substances.

Scheme of implementation of European Union Policy to the level of municipal plans, from the point of view of increasing the number of nearly zero-energy buildings is shown in Figure 7.9.

Figure 7.9. Scheme of implementation of European Union Policy to the level of municipal plans from the point of view of increasing the number of nearly zero-energy buildings



Source: own

[259] Act of 10 April 1997 on energy law ("Journal of Laws" No. 54, item. 348).

[260] Act of 21 November 2008 on supporting modernization and repairs ("Journal of Laws" No. 223, item. 1459).

[261] Act of 15 April 20122 on energy efficiency (Dz.U 2011 Nr 94, item 551).

1. Polish Energy Policy until 2030

In November 2009, the Council of Ministers adopted the document "Polish Energy Policy until 2030". This document was prepared on the basis of the Act of Energy Law. Polish Energy Policy document presents the strategy of the state, having to answer the most important challenges facing the Polish energy sector, both in the short term, and in the perspective of 2030. The main objectives of Polish energy policy in the energy efficiency area are:

- maintaining the zero-energy growth, which means economic growth without growth in the primary energy demand,
- consistent reducing the energy consumption of the Polish economy to the level of the EU-15.

Specific objectives related to energy efficiency are:

- increasing the efficiency of electricity generation through the construction of high-efficiency units;
- doubling electricity produced in cogeneration technology by 2020, as compared to production in 2006,
- reducing network losses in transmission and distribution,
- increasing the efficiency of end-use energy;
- increasing the ratio of annual demand for electricity to the maximum demand for power at peak load.

2. The National Energy Efficiency Action Plan for Poland 2011 (NEEAP)

The Second National Energy Efficiency Action Plan for Poland 2011 (NEEAP) fulfills the requirements of the Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 *on energy end-use efficiency and energy services* (article 14.2) and Directive **2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings. This document also fulfills the provisions of internal act – article 6 Act of 15 April 20122 on energy efficiency**[262]**. The second National Action Plan includes measures to improve energy efficiency focused on end-use energy savings and calculations of energy obtained in the period 2008-2009.** This NEEAP also contains the expected level of energy savings in 2016 in accordance with the requirements of Directives. This document has been prepared by the Ministry of Economy, with the involvement of the Ministry of Infrastructure, the Central Statistical Office (GUS) and the National Agency for Energy Conservation S. A. (KAPE). Minister of Infrastructure

[262] Act of 15 April 20122 on energy efficiency (Dz.U 2011 No 94, item 551).

is responsible for reporting in relation to the Directive *on the energy performance of buildings* 2010/31/EC.

The national target for efficient energy management has been defined in the first National Action Plan for Energy Efficiency (EEAP) 2007[263]. This objective concerns obtaining in 2016 savings in final energy consumption in the amount of not less than 9% of the average domestic energy use per year.

This document also contains a description of the measures to improve energy efficiency by sectors, and economic incentives and financing instruments for promotion of nearly zero-energy buildings, as follows:

- white certificate scheme,
- thermo-modernisation premium (overhaul and thermo-modernisation Fund, thermo-modernisation of public buildings) and renovation premium,
- green certificates (promotion of renewable energy sources),
- options for co-financing investments in RES (vational and voivodship Funds for Environmental Protection and Water Management, EU funds),
- European Economic Area,
- 16 Regional Operational Programmes,
- financial support for purchase and installation of solar collectors for individuals and housing cooperatives.
- improving energy efficiency (part 3) – financial support to credit the construction of energy-efficient homes.

Samples of priority programmes implemented by the government to improve energy efficiency in the building sector (Figure 7.10):

1. Energy efficiency improvement measures in the residential sector (Table 7.1).
   - Thermo-modernization and renovation;

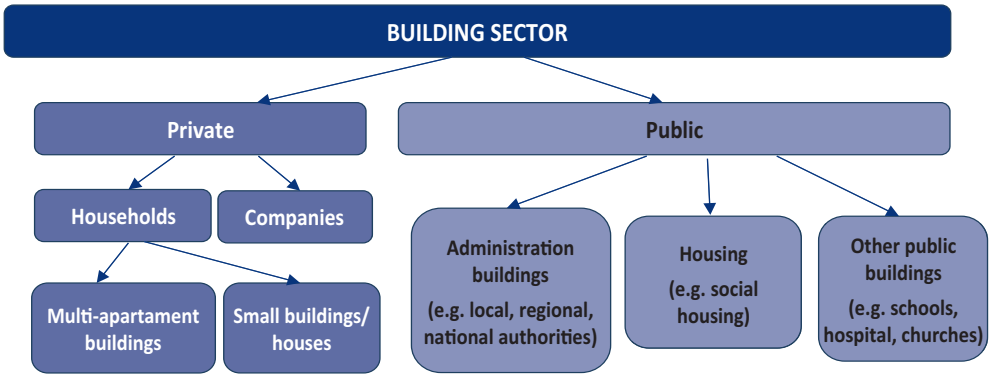
2. Energy efficiency improvement measures in public sector:
   - Green Investment Scheme (Part 1) – energy management in buildings of public utility,
   - Green Investment Scheme (Part 5) – energy management in buildings of selected public finance sector entities,
   - Operational Programme "Energy conservation and promotion of renewable energy sources" for the use of funds under the Mechanism EEA Financial Mechanism and the Norwegian Financial in 2012-2017;

[263] National Energy Efficiency Action Plan (NEEAP) 2007, Ministry of the Economy, Warsaw, June 2007.

3. Activities in the industrial sector:
   - Energy efficiency (Part 1) – Financing for energy audits and power in enterprises,
   - Efficient use of energy (Part 2) – Funding of investment projects leading to energy savings or to increase energy efficiency companies
   - Programme Priority Smart energy networks,
   - Green Investment Scheme (Part 2) – Modernization and development of heat.

Moreover, this document shows the exemplary role of public administration.

Figure 7.10. Main areas to improve energy efficiency in buildings



Source: own.

Thermo-modernisation and renovation in the residential sector

The primary objective of the Act of 21 November 2008 on supporting modernization and repairs is the financial support for investors who want to improve the technical condition of the existing housing stock, especially common parts of multi-family buildings and reduce the final energy consumption objectives for heating. The target group of this programme are owners of multi-family buildings. Monitoring authority is the Ministry of Infrastructure.

Green Investment Scheme[264] (Part 1) – energy management in buildings of public utility

This priority programme was adopted by the National Fund for Environmental Protection and Water Management (NFEP&WM)[265] on 22 March 2011. The aim

[264] More information: http://www.nfosigw.gov.pl/en/priority-programmes/green-investment-scheme/

[265] The National Fund of Environmental Protection and Water Management (NFEP&WM) which was established in 1989. This institution is the pillar of the Polish system of financing environmental protection.

is to reduce the energy consumption in buildings of public utility. The target group of this programme are administration buildings (local, regional, national authorities), other public buildings (e.g. schools, hospitals, churches, etc.). This program concerns thermo modernisation and renovation of buildings in the public sector. According to the Polish Act on the System to Manage the Emissions of Greenhouse Gases and Other Substances[266], the monitoring authority is NFEP&WM.

Green Investment Scheme (Part 5) – energy management in selected buildings of public finance sector entities

This priority programme was adopted by the National Fund for Environmental Protection and Water Management (NFENWM) on 22 March 2011.Its aim is to reduce the energy consumption in buildings of public utility. This programme concerns thermo-modernisation and renovation of the public sector buildings. The target group of this programme are Polish Academy of Sciences, public buildings of cultural institutions and institutional buildings of budget economy. Monitoring authority is NFEP&WM.

3. National Renewable Energy Action Plans[267]

National Action Plan for Energy from Renewable Sources, is fulfilling the obligation under Art. 4 paragraph. 1 Directive of the European 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. National Action Plan on Energy from Renewable Energy Sources has been prepared on the basis of the scheme prepared by the European Commission (Commission Decision 2009/548/EC of 30 June 2009 establishing the scheme of national action plans for energy from renewable sources by Directive 2009/28/EC of the European Parliament and the Council).

According to Art. 13 paragraph. 3 Directive of the European 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and subsequently, Poland doesn't have provisions that would require the installation and use of RES in new buildings and renovated buildings. With regard to promoting RES the legislator has introduced a model of incentives and bonuses. These bonuses can be obtained by an investor under the Act of 21 November 2008 on supporting

[266] Act of 17 July 2009 on the System to Manage the Emissions of Greenhouse Gases and Other Substances.

[267] National Renewable Action Plans, Ministry of Economy, Warsaw 2010.

modernization and repairs[268]. Measures to promote renewable energy sources at regional and local levels are concerned with providing support in terms of financing. Currently, the primary support at the local level are measures of provincial funds for environmental protection and water management. According to the environmental law these funds shall be allocated to support the use of local renewable energy sources and for the introduction of more environmentally-friendly energy.

Furthermore, this document introduces the definition of "nearly zero – energy buildings". **A nearly zero – energy building** means a building with a very high energy performance. The nearly zero or very low amount of energy required should come at a very high level from renewable sources, including renewable energy produced at or near the building. In addition, the energy performance certificate may contain additional information such as the percentage of energy from renewable sources in the total energy consumption. Estimated share of energy from renewable sources in Poland is shown in Table.1.

Table 7.1. Estimated share of energy from renewable sources in the building sector and heat by technology 2020 in Poland (%)

	2010	2015	2020
Type of buildings			
Residential buildings	11.0 %	14.0 %	16.0 %
Public buildings	10.0 %	13.0 %	15.0 %
Commercial and Industrial buildings	9.0 %	12.0 %	14.0 %
Total	10.0 %	13.0 %	15.0 %
Heat by technology 2020			
Geothermal	-	-	3.0 %
Solar	-	-	8.5 %
Biomass	-	-	85.9 %
Haet pumps	-	-	2.5 %

Source: based on National Renewable Action Plans, Ministry of Economy, Warsaw 2010.

4. Assumptions of National Programme for the Development of Low-Carbon Economy (pl.: NPRGN – Narodowy Program Rozwoju Gospodarki Niskoemisyjnej)[269].

The general objective of National Programme for the Development of Low-Carbon Economy is to ensure economic, social and environmental benefit in

[268] Act of 21 November 2008 on supporting modernization and repairs ("Journal of Laws" No. 223, item. 1459).

[269] http://www.mg.gov.pl/Bezpieczenstwo+gospodarcze/Gospodarka+niskoemisyjna/Narodowy+Program+Rozwoju+Gospodarki+Niskoemisyjnej

accordance with the rules of sustainable development. These aims can be achieved through measures that require reduction in greenhouse gas emissions performance, among others, by an increase in innovation and implementation of new technologies, reduction in energy consumption, creating new jobs and, consequently, growth-enhancing economic competitiveness. On 16th August 2011, the Council of Ministers adopted the Assumptions of the National Development Plan for Low-Carbon Economy.[270] This programme will be introduced to all sectors of the economy, economic and territorial governments, business support organizations, NGOs and every citizen of Poland, in order to shape proper behaviours and social activity in this area.

5. National Regional Development Strategy 2010-2020. Regions, cities, rural areas[271] (pl.: Krajowa Strategia Rozwoju Regionalnego 2010-2020. Regiony, miasta, obszary wiejskie)

National Regional Development Strategy 2010-2020 determines the purposes and methods of operation of public bodies, in particular the government and regional governments, in relation to the Polish public space to achieve the strategic goals of development of the country. This document sets out the objectives of regional development policy, including rural and urban areas, and defines their relationships with respect to other public policies with a strong territorial orientation.

Obligation to implement the guidelines contained in the national plans, programme documents and from the national level to the level of the province and county/municipalities is defined in the Act of 6 December 2006 on policy principles of development. According to Article 3. policy development is led by:

1. **the Council of Ministers,**
2. **the provincial government,**
3. **the county government and the municipal.**

7.2.3. General information about energy efficiency

Energy Efficiency

In accordance with the Act of 15 April 2011 on *energy efficiency*[272], the definition of energy efficiency is 'the ratio of the obtained effect sizes utility of

[270] http://www.mg.gov.pl/files/upload/10460/NPRGN.pdf

[271] National Regional Development Strategy 2010-2020. Regions, cities, rural areas, Warsaw, 13 July 2013 (http://www.mir.gov.pl/aktualnosci/polityka_rozwoju/documents/ksrr_13_07_2010.pdf).

[272] Act of 15 April 2011 *energy efficiency* ("Journal of Laws" No. 94, item. 551 późn. zm).

the object, a technical device or system, in typical conditions for its use or operation, the amount of energy consumption by this object, technical device or installation, necessary to obtain this effect'.

Improving energy efficiency is an important element of energy policy of the European Union and Poland. In 2007, the Ministry of Economy adopted the National Energy Efficiency Action Plan (EEAP 2007), which defined target energy savings and indicated the main areas of action:

1. housing sector,
2. services sector – assuming the exemplary role of public sector services,
3. industry within the meaning of the final consumer and energy companies,
4. transport sector (excluding aviation and shipping).

In addition, the basic premises of the Polish Energy Policy until 2030 are shown. According to the plan, the issue of energy efficiency is treated as a priority in the energy policy. Progress in this area will be a key to achieving all of its objectives. Therefore, all possible measures contributing to increased energy efficiency in Poland, need to be taken.

Energy Efficiency Act

Improved energy efficiency and the rational use of existing energy resources, in view of the increasing demand for energy, are areas to which Poland attaches great importance. The priority objective of the government was to create a legal framework and a system of support measures to improve energy efficiency. Energy efficiency Act of 15 April 2011[273], defines the purpose of energy savings, taking into account the leading role of the public sector, establishing support mechanisms and a system of monitoring and collection of the necessary data. This Act came into force on 11 August 2011. The Act also provides a full implementation of European directives in the field of energy efficiency, in particular the provisions of Directive 2006/32/EC on energy end-use efficiency and energy services.

This Act specifies:

1. The principle of supporting thermo-modernisation aimed at:
   - reducing the consumption of energy supplied to residential and public buildings for heating and water heating,
   - reduction of energy losses in the local district heating networks and supplying them with local heat sources, if there were taken measures to reduce the consumption of energy delivered to the buildings,

[273] Act of 15 April 2011 on energy efficiency ("Journal of Laws" of 2011, No. 94, item. 551).

- the total or partial replacement of conventional energy sources by unconventional sources, including renewables,

2. The rules for creating the Fund to dispose of its thermo-measures.

Thermal modernisation of public service buildings

High potential for energy savings in the building sector and the fact that this sector is responsible for 40% of final energy consumption in the European Union means that investments in improving energy efficiency in this sector are very important. In Poland, the programme enables modernization of such buildings which require it most. In 1999, the Act on supporting modernization and renovation[274] was implemented. This programme aims to provide technical and financial support to projects in the field of energy savings in buildings and projects relating to the reduction of heat loss in distribution networks or replacing traditional sources by unconventional energy sources, including renewables. Investors can receive a 20% refund on the amount of credit for projects.

The tasks of the public sector in energy efficiency

In accordance with article 8 of the Act of 15 April 2011 on energy efficiency[275], the Minister of Economy shall prepare and submit to the Council of Ministers, every two years, a report containing information relating to the national objective of efficient energy management and a national action plan on energy efficiency together with the assessment and conclusions of their implementation. One of the biggest government support programmes for energy efficiency is Thermo-modernization Fund directed to the housing sector and the service sector.

7.2.4. Planning and management at a local level. Plans for a low-carbon economy in municipalities

The main objectives of the plans for a low-carbon economy at a national level

National plans should include low-carbon economy, which will contribute to achieving the objectives set out in the climate and energy package for 2020, namely:

- reducing greenhouse gas emissions;
- increasing the share of energy from renewable sources;

[274] ("Journal of Laws" of 1998 No. 162, item. 1121).

[275] Act of 15 April 2011 on energy efficiency ("Journal of Laws" of 2011 No. 94, item. 551, as amended).

- reducing final energy consumption, which will be achieved by improving energy efficiency,
- improving air quality.

Basic requirements for a plan for a low-carbon economy

Admission to the realization of this plan at the Municipal Council level includes:

- relevance of the plan at the time of the settlement agreement for funding under Measure 9.3;
- indication of measures to achieve the objectives,
- confirmation of objectives for 2020,
- identifying sources of financing,
- plan implementation, monitoring and verification (procedure),
- the complexity of the plan,
- consistency with other plans/programmes (local development plan, objectives/plan for the supply of heat, electricity and fuel gas, air protection programme);
- compliance with laws and regulations in the field of strategic environmental assessment (if required).

The part of the plan for low-carbon economy at the municipal council level provides general guidelines for investment in areas:

- energy consumption in buildings/installations:
  - **buildings and municipal facilities,**
  - **buildings and equipment for non communal services,**
  - **residential buildings,**
  - street lighting;
  - optional – industrial plants.
- energy consumption in transport:
  - public transport,
  - rolling municipal,
  - private and commercial transport,
  - rail transport.
- waste management – in terms of emissions not related to energy consumption (CH_4 from landfills) – optional.
- energy production – factories/plants for the production of:
  - electricity,
  - heat and cold,
  - with the exception of installations covered by the EU ETS.

The part of a plan for low-carbon economy at the municipal council level provides general guidelines for non-investment, in areas:

- urban planning,
- procurement,
- communication strategy to promote low-carbon economy, etc.

Details on the structure of a low-carbon economy plan in municipalities

- Priority IX. Environmentally-friendly energy infrastructure and energy efficiency. Measure 9.3. Thermal modernisation of public buildings, plans for a low carbon economy Plans for a low-carbon economy in communities funded under Axis OPI IX 2007-2013 "Friendly energy infrastructure and energy efficiency" action 9.3.

Specific requirements:

Part I. Planning process:

1. The main objectives of the plans for a low-carbon economy;
2. Guidelines for the preparation of the plan for a low-carbon economy;
3. Basic requirements for the plan;
4. The recommended structure of the plan;

Part II. Management process:

5. Monitoring Indicators.

Part I. Planning process

1. The main objectives of the plans for a low-carbon economy in municipal areas

Plans for a low-carbon economy in municipal areas includes low-carbon economy contribution to achieving the objectives set out in the climate and energy package for 2020, namely:

- reduction of greenhouse gas emissions,
- increasing the share of energy from renewable sources;
- reduction in final energy consumption, which is to be achieved by improving energy efficiency,

and improving air quality in areas where there have been exceeded quantity levels of permissible concentrations in the air and implemented programmes (remedial) on air protection (POP) and short-term action plans (PDK). Activities included in plans must be consistent with the created POP and PDK and lead to a reduction of emissions of air pollutants (including particulate matter, sulfur

dioxide and nitrogen oxides). Due to the lack of planning by municipalities of concrete actions and budgets for a period of seven years, local governments can provide a range of operational plans covering the next 3-4 years from the moment of approval of the plan. The actions must be consistent with the Multiannual Financial Forward – WPF.

2. Guidelines for the preparation of the plan for a low-carbon economy

Guidelines for the preparation of the low-carbon economy should include the following aspects:

- range of activities at the level of municipalities,
- for the entire geographical area of municipalities,
- focus on the actions of low-carbon and resource-efficient, including improving energy efficiency, use of renewable energy sources. This means using all measures aimed at reducing emissions of air pollutants including particulate matter, sulfur dioxide, nitrogen oxides and carbon dioxide emissions, with particular attention to areas where there were exceeded the permissible concentrations in the air;
- participation of entities which are producers and/or consumers of energy (with the exception of installations covered by the EU ETS), with particular emphasis on activities in the public sector,
- plans to cover areas where local authorities have an impact on energy consumption in the long term (including planning),
- taking action to promote energy-efficient products and services (e.g. public procurement),
- action affecting the change in consumer attitudes as energy users (in cooperation with local residents and stakeholders, educational activities),
- consistency with new or updated from the assumptions of the plans for heat, cooling and electricity or fuel gas (or the assumptions for these plans) and air protection programmes.

3. Basic requirements for a plan

Basic requirements for a plan include the following aspects:

- adoption of the plan by resolution of the Municipal Council (enter to WPF)
- relevance of the plan at the time of the settlement agreement for funding under Measure 9.3,
- identifying measures to achieve the objectives,
- identifying sources of financing,
- plan implementation, monitoring and verification (procedure),

- consistency with other plans/programmes (local development plan, objectives/plan for the supply of heat, electricity and fuel gas, air protection programme),
- compliance with laws and regulations in the field of strategic environmental assessment,
- energy production – factories/plants for the production of electricity, heat and cold, with the exception of installations covered by the EU ETS and non-investment tasks, such as urban planning, procurement, communication strategy to promote low-carbon economy, etc.
- complexity of the plan, it means an indication of investment projects in the following areas:
  - energy consumption in buildings (Figure 2) / installations (buildings and municipal facilities, buildings and equipment for non-communal services, residential buildings, street lighting, industrial plants outside the EU ETS – optional), heat distribution,
  - consumption of energy in transport (public transport, rolling municipal, private and commercial transport, rail transport), including through the implementation of traffic management systems,
  - Waste management – in terms of emissions not related to energy consumption (CH_4 from landfills) – optional.

4. The recommended structure plan

- Summary
- The overall strategy:
  - strategic and detailed objectives,
  - current status,
  - identification of problem areas,
  - organisational and financial aspects (organizational structures, resources, people, parties involved, budget, sources of financing, financial resources for monitoring and evaluation);
- The results of a baseline emission inventory of carbon dioxide
- The activities/tasks and measures planned for the entire period covered by the plan
  - Long-term strategy, objectives and commitments,
  - Short/medium-term actions/tasks

These strategies should include:

- A description of the strategy, objectives and commitments,
- Those responsible for the task,

- Scheduling tasks,
- Costs,
- Indicators of the task.

Part II. Management process

5. Monitoring Indicators

- the reduction in CO_2 emissions compared to the previous years (1990 or other possible indicators,
- the reduction in final energy consumption in relation to the adopted base year,
- the share of energy consumed from renewable sources,
- proposed monitoring indicators based on the methodology developed by the Joint Research Centre (JRC) of the European Commission in collaboration with the Directorate General for Energy (DG ENER) and the Covenant of Mayors Office, contained in the guide *"How to develop an action plan for sustainable energy (SEAP)"*[276]

In order to determine the level of reduction of energy consumption, obtained by increasing the energy efficiency, it is recommended to use the data contained in the energy audits.

7.2.5. How to prepare guidelines for plans in cities

Starting the preparation stage with the assumptions of the plan requires an answer to the question: Why do municipalities need low-carbon efficient plan?

Answer to this question is not simple, because several aspects must be taken into account:

- Economic aspect (e.g. very high cost of heat, electricity and gas, potential source of significant savings),
- Legal aspect (e.g. energy requirements of the law and its provisions (especially Article 18 and Article 19 – Act of Energy Law[277]),
- Improving energy security (Liabilities of a climate and energy package),
- Improving air quality (The use of local energy sources).

[276] How to develop a sustainable energy action plan (SEAP) – Guidebook, Luxembourg: Publications Office of the European Union, 2010 (http://www.porozumienieburmistrzow.eu/IMG/pdf/seap_guidelines_en.pdf).

[277] Act of 10 April 1997 *on energy law* ("Journal of Laws" No. 54, item. 348).

In accordance with Article 18 Act of 10 April 1997 on energy law[278], tasks of the municipality in terms of electricity supply, heat and gas fuels include:

1. planning and organizing the supply of heat, electricity and fuel gas in the municipal area;
2. planning the lighting of public places and the roads in the community;
3. the financing of lighting streets, squares and public roads located in the municipality. Municipality should carry out these tasks, in accordance with:
   - local spatial development plan, and the absence of such a plan – with the directions contained in a commune development plan, in the study of conditions and directions of spatial development plan of the commune[279],
   - the appropriate air protection programme adopted pursuant to art. 91 of the Act of April 27, 2001 – The Environmental Protection Law[280].

The draft guidelines should specify:

1. assessment of the current and anticipated changes in demand for heat, electricity and gas fuels;
2. rationalizing the use of heat, electricity and gas;
3. the possibility of using existing surplus and local fuel resources and energy, including electricity and heat produced from renewable energy sources, electricity and useful heat produced in cogeneration and waste heat from industrial installations;
4. the scope of cooperation with other municipalities.

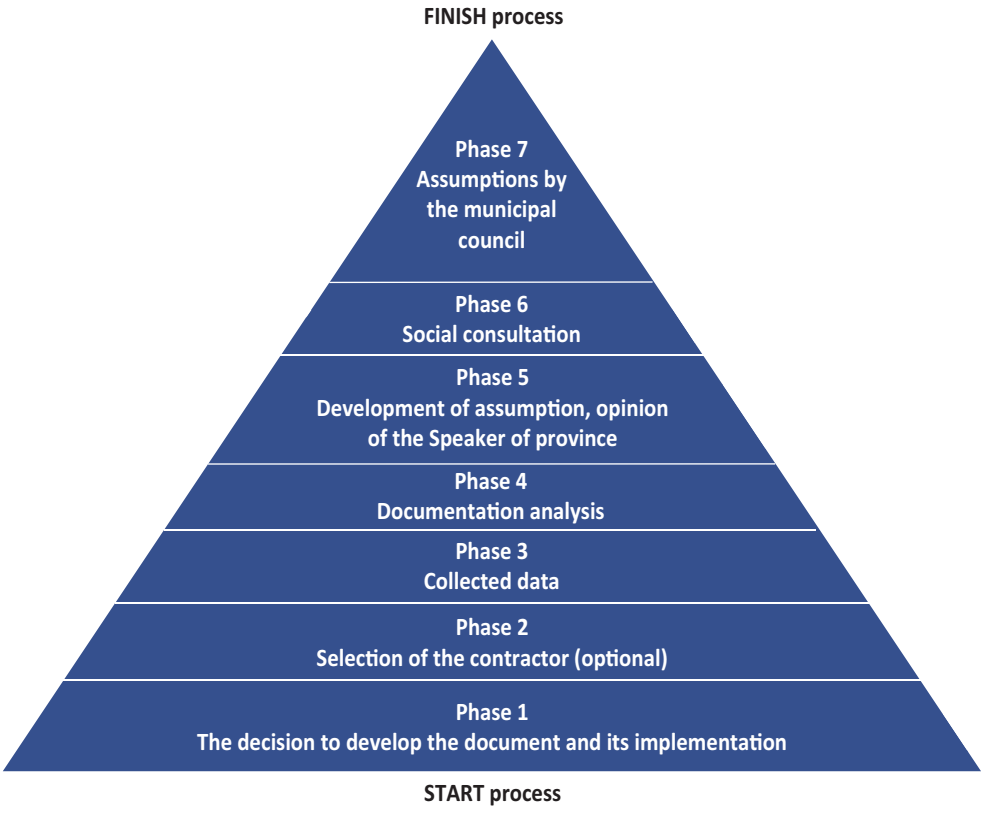
The preparation phase assumptions for low – carbon efficient plans include 7 phases (figure 7.11).

[278] Act of 10 April 1997 *on energy law* ("Journal of Laws" No. 54, item. 348).

[279] Act of on Spatial Planning and Development.

[280] Act of April 27, 2001 on the environmental protection law.

Figure 7.11. The preparation phase assumptions for low – carbon efficient plans



Explanation to the Figure 7.11.

- Phase 1. In this phase there should be determined the procedure of the implementation of the document (our forces, expert or mixed model).
- Phase 2. This phase is optional and depends on the size of the project.
- Phase 3. This phase applies to the questionnaire, collect data from utility and gas, information about the village) – the contractor/office.
- Phase 4. This step applies to the analysis of documents (e.g. strategy of municipality development, the study of conditions for land development, environmental programme, a programme for local development, etc.), and collected data.
- Phase 5. The development of the plan objectives and sending it to get the opinion of the Marshal. This process concerns the scope of cooperation with other municipalities and compliance with Polish Energy Policy.
- Phase 6. Social consultation. In this section opinions and suggestions of stakeholders regarding the plan being developed are collected.
- Phase 7. Assumptions by the Municipal Council.

Communication strategy with stakeholders

Preparing to promote low-carbon economy plan needs the support of and cooperation with stakeholders and other organizations. The local government should prepare the communication strategy. Obligation to carry out public consultation results from the Act of 3 October 2008 on the provision of information about the environment and its protection, public participation in environmental protection and environmental impact assessment[281]. According to Article 42 point 2, carrying out a strategic environmental assessment of the following projects require: policies, strategies, plans or programmes in the fields of industry, energy, transport, telecommunications, water management, waste management, forestry, agriculture, fisheries, tourism and land use, developed or adopted by the administrative bodies, defining the framework for the implementation of projects that may significantly affect the environment.

The members of a local community play a key role in solving the problem concerning energy saving and climate protection at the city/municipality level. Local authorities should work together with the stakeholders to develop a vision for the future, specify the paths of urban/municipal development and involve the necessary human and financial resources. Moreover, the involvement of the local population is the starting point to stimulate changes in behaviour and social attitudes in a more environmentally-friendly way. The views of citizens and stakeholders should be known already at the stage of developing detailed guidance plan for the city/municipality. Therefore, citizens and other stakeholders should be involved in the key stages of the plan development. This includes building a vision, defining goals and objectives, setting priorities, etc. Public involvement in the process of preparing the plan provides a long-term acceptance, profitability and support for these strategies.

The potential roles that the key actor can play in the planning process are shown in figure 7.12-7.13. This process contains four phases of communications with different roles for the actors.

[281] Act of 3 October 2008 on the provision of information about the environment and its protection, public participation in environmental protection and environmental impact assessment (Dz.U. 2008 No 199, item 1227).

Figure 7.12. Example of roles of the key actors in planning process – phase 1-2

THE SEAP PROCESS: THE MAIN STEPS – ROLE OF THE KEY ACTORS			
STEP	ROLE OF THE ACTORS		
	Municipal council or equivalent body	Local administration	Stakeholders
PHASE: Initiation			
Political commitment and signing of the Covenant	Make the initial commitment. Sign the Covenant of Mayors. Provide the necessary impulse to the local administration to start the process.	Encourage the political authorities to take action. Inform them about the benefits (and about the necessary resources).	Make pressure on political authorities to take action (if necessary).
Adapt city administrative structures	Allocate sufficient human resources and make sure adequate administrative structures are in place.		
Build support from stakeholders	Provide the necessary impulse for stakeholders' participation. Show that you consider their participation and support as important.	Identify the main stakeholders, decide what channels of communication/ participation you want to use. Inform them about the process that is going to start, and collect their views.	Express their views, explain their potential role in SEAPs.
PHASE: Planning phase			
Assessment of the current framework: Where are we?	Make sure the necessary resources are in place for the planning phase.	Conduct the initial assessment, collect the necessary data, and elaborate the CO_2 baseline emission inventory. Make sure the stakeholders are properly involved.	Provide valuable inputs and data, share the knowledge.
Establishment of the vision: Where do we want to go?	Support the elaboration of the vision. Make sure it is ambitious enough. Approve the vision (if applicable).	Establish a vision and objectives that support the vision. Make sure it is shared by the main stakeholders and by the political authorities.	Participate in the definition of the vision, express their view on the city's future.
Elaboration of the plan: How do we get there?	Support the elaboration of the plan. Define the priorities, in line with the vision previously defined.	Elaborate the plan: define policies and measures in line with the vision and the objectives, establish budget and financing, timing, indicators, responsibilities. Keep the political authorities informed, and involve stakeholders. Make partnerships with key stakeholders (if necessary).	Participate in the elaboration of the plan. Provide input, feedback.
Plan approval and submission	Approve the plan and the necessary budgets.	Submit the SEAP via the CoMO website. Communicate about the plan.	Make pressure on political authorities to approve the plan (if necessary).

Source: How to develop a sustainable energy action plan (SEAP) – guidebook, Luxembourg: Publications Office of the European Union, 2010.

Figure 7.13. Example of role of the key actors in planning process – phase 3-4

STEP	ROLE OF THE ACTORS		
	Municipal council or equivalent body	Local administration	Stakeholders
PHASE: Implementation phase			
Implementation	Provide long-term political support to the SEAP process.	Coordinate the implementation plan. Make sure each stakeholder is aware of its role in the implementation.	Each stakeholder implements the measures that are under its responsibility.
	Make sure that the energy and climate policy is integrated in the every day life of the local administration.	Implement the measures that are under responsibility of the local authority. Be exemplary. Communicate about your actions.	Make pressure/encourage the local administration to implement the measures under its responsibility (if necessary).
	Show interest in the plan implementation, encourage stakeholders to act, show the example.	Motivate the stakeholders to act (information campaigns). Inform them properly about the resources available for EE and RES.	Changes in behaviour, EE and RES action, general support to SEAP implementation.
	Networking with other CoM signatories, exchanging experience and best practices, establishing synergies and encouraging their involvement in the Covenant of Mayors.		Encourage other stakeholders to act.
PHASE: Monitoring and reporting phase			
Monitoring	Ask to be informed regularly about the advancement of the plan.	Proceed to a regular monitoring of the plan: advancement of the actions and evaluation of their impact.	Provide the necessary inputs and data.
Reporting and submission of the implementation report	Approve the report (if applicable).	Report periodically to the political authorities and to the stakeholders about the advancement of the plan. Communicate about the results. Every second year, submit an implementation report via the CoMO website.	Provide comments on the report and report on the measures under their responsibility.
Review	Ensure that plan updates occur at regular intervals.	Periodically update the plan according to the experience and the results obtained. Involve political authorities and stakeholders.	Participate in plan update.

Source: How to develop a sustainable energy action plan (SEAP) – guidebook, Luxembourg: Publications Office of the European Union, 2010.

More information about social participation see in chapter Social participation.

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Chapter 8

Waste management

Anna Stankowska

"The rich and vain society can be identified by a large amount of waste generated ....
....Eco-friendly and responsible society can be identified by their lack ..."

A. Stankowska, PhD

Preface

Waste in Europe is one of the most important problems corresponding to environmental protection. Generation of waste is a growing problem on a national and world scale. This is due to the growing population, increasing production of consumer goods and accelerating technological progress. Significant technological progress causes a shortening of life – cycle of some groups of products, especially those of common use.

In order to prevent further degradation of the environment through the creation of waste, the European Union began to introduce its preventive measures. The creation of an appropriate legal framework is expected to contribute to:

- waste prevention and reduction of its amount and reducing the negative impact that waste has on the environment during the processes of products manufacturing, usage and at the end of their duration,
- ensuring compliance with the rules of environmental recovery,
- ensuring compliance with the rules of environmental waste.

The waste management planning process is shown in this chapter.

8.1. Waste – general information about amount of waste in EU

The amount of waste generated is an important indicator, for example, to assess the economic situation of the country, or region. This indicator is used for instance to monitor patterns of consumption and resource efficiency of industrial production. It can be also used to measure the increase or decrease in the amount of waste generated over time and differences between countries in a generation.

In an attempt to identify the scale of the problem of waste we should ask a question: How long until it's gone? (Figure 8.1). The answer to this question will primarily assess the scale of the problem and will help us to take adequate measures. It is therefore worth to look at the statistics on waste.

Figure 8.1. Estimated decomposition rates of common marine debris item

Source: http://imgur.com/r/infographics/O3NeIHi

Waste generated by residents of the European Union

According to Eurostat, in 2010 Polish households produced approximately 8.9 million tonnes of waste. The Spanish households produced 23 million tonnes, Greek – 5.1 million, German – more than 36 million. United Kingdom, according to the statistics, produced nearly 30 million tonnes of waste. In total, twenty-seven countries produced 218.5 million tonnes of waste (Table 8.1).

The municipal waste generated per person in the UE is shown in Table 8.1-8.2. According to these statistics, the greatest amount of waste was generated in Cyprus – 760 kg/per person, and the smallest in Estonia – 311 kg/per person.

According to the data presented in Table 1, the largest increase in the generation of waste by households in 2004-2010 occurred in Lithuania and Bulgaria. Whilst, the largest decrease in the amount of waste generated occurred in Hungary and Belgium.

The level of recycling in the EU

Eurostat has calculated that the level of recycling of packaging waste in 2010 in Poland reached almost 39%, in Spain 61%, in Greece 58%, in Germany 72.7%, in the UK about 68%. The highest level of recycling of packaging waste was found in Belgium – at the level of nearly 80%. Overall in the EU in 2010 the ratio was 63.3%.

Table 8.1. The level of waste generated by households, EU 2004-2010

	Total waste generated by Households [kilograms per capita]				
GEO/TIME	**2004**	**2006**	**2008**	**2010**	**Different (2010-2004)**
Austria	421	449	458	551	130
Belgium	511	450	416	428	-83
Bulgaria	338	380	388	477	139
Cyprus	505	475	550	556	51
Czech Republic	279	340	306	318	39
Germany (until 1990 former territory of the FRG)	461	420	435	444	-17
Denmark	373	381	458	439	66
Estonia	295	306	329	323	28
Greece	381	371	354	466	85
Spain	569	542	532	498	-71
European Union (27 countries)	**431**	**437**	**441**	**439**	**8**
Finland	223	226	315	313	90
France	411	423	457	452	41
Hungary	439	296	345	286	-153
Ireland	418	463	374	379	-39
Italy	540	559	552	548	8
Lithuania	178	397	426	407	229
Luxembourg	482	405	565	493	11
Latvia	240	385	278	331	91
Malta	330	321	356	333	3
Netherlands	581	576	574	546	-35
Norway	421	472	467	456	35
Poland	177	181	180	233	56
Portugal	437	441	488	517	80
Romania	170	300	317	303	133
Sweden	454	478	476	431	-23
Slovenia	331	543	353	355	24
Slovakia	275	302	329	319	44
Turkey	411	412	400	405	-6
United Kingdom	517	534	510	461	-56

Source: Eurostat, 20.03.2014

The amount of waste in Poland

According to the statistics published by the Central Statistical Office[282] in 2011, the number of non-municipal waste generated in Poland amounted to 123.5 million tonnes. This was an increase relative to the previous year of 10 million tonnes, or 8.5%. Most waste comes from washing and cleaning of minerals and ore flotation of non-ferrous metals. 72% of the non-municipal waste in 2011 was recovered, and another 25 % was disposed of.

The amount of municipal waste in Poland

Poles have produced about 12 million tonnes of municipal waste (related to non-industrial human activity, that is most at home). Therefore, on average, every citizen of Poland produces about 315 kg of garbage per year.

The level of recycling of packaging waste in Poland

The achieved level of recycling of packaging waste in 2011 amounted to 41.3%. In terms of the types of garbage, the highest level of recycled material concerned paper – 58.7%. Among the provinces Opole proved to be the best with a score of 48,7% this number exceeded 100% because it included the surplus from the previous year. In the second place was the Podlasie with a score of 157% and in the third Silesia with a pointer just over 156%.

In Poland municipal waste segregation is not obligatory. However, in accordance with the Act on the maintenance of cleanliness and order in the municipalities[283], those who sort garbage pay less for waste collection.

Landfills in Poland

At the end of 2011 there were 578 controlled landfills in Poland. Most of them, as many as 68 in Wielkopolskie voivodeship, 65 in Mazowieckie, 62 in Lubuskie, and at least 14 in Świętokrzyskie. There were a little over 720 installations on waste recovery and disposal of waste.

[282] http://stat.gov.pl/en/

[283] Act on the maintenance of cleanliness and order in the municipalities (Dz.U. 2005, No 236, item 2008).

Table 8.2. Municipal waste in EU produced by the Member State, 2010

	Municipal waste generated, kg per person	Total municipal waste treated, kg per person	Municipal waste treated, %			
			Landfilled	Incinerated	Recycled	Composted
EU27	**502**	**486**	**38**	**22**	**25**	**15**
Belgium	466	434	1	37	40	22
Bulgaria	410	404	100	-	-	-
Czech Republic	317	303	68	16	14	2
Denmark	673	673	3	54	23	19
Germany	583	583	0	38	45	17
Estonia	311	261	77	-	14	9
Ireland	636	586	57	4	35	4
Greece*	457	457	82	-	17	1
Spain	535	535	58	9	15	18
France	532	532	31	34	18	17
Italy*	531	502	51	15	21	13
Cyprus	760	760	80	-	16	4
Latvia	304	304	91	-	9	1
Lithuania	381	348	94	0	4	2
Luxembourg	678	678	18	35	26	20
Hungary	413	413	69	10	18	4
Malta	591	562	86	-	7	6
Netherlands	595	499	0	39	33	28
Austria*	591	591	1	30	30	40
Poland	315	263	73	1	18	8
Portugal	514	514	62	19	12	7
Romania	365	294	99	-	1	0
Slovenia	422	471	58	1	39	2
Slovakia	333	322	81	10	4	5
Finland	470	470	45	22	20	13
Sweden	465	460	1	49	36	14
United Kingdom*	521	518	49	12	25	14

* Estimated by Eurostat
0 equals less than 0.5%, '-' indicates a real zero

Source: Waste Management in Central and Eastern Europe, CMS Cameron McKenna LLP 2013.

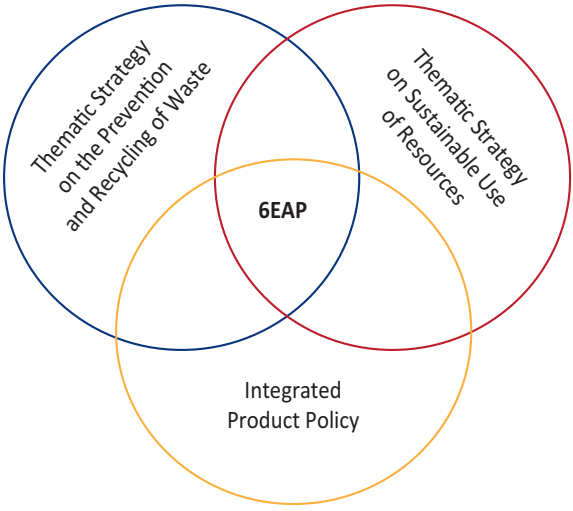
8.2. Legal basis for waste – European policies and strategies

Thematic Strategy on the Prevention and Recycling of Waste – wielkie litery? (TAK)

The Thematic Strategy on the Prevention and Recycling of Waste is one of the strategies programmed by the 6th Environmental Action Plan (EAP – Figure 8.2):

- Communication COM(2005) 666 final,
- Technical annexes of the Communication SEC (2005) 1682,
- Impact Assessment SEC(2005) 1681,
- Press release.

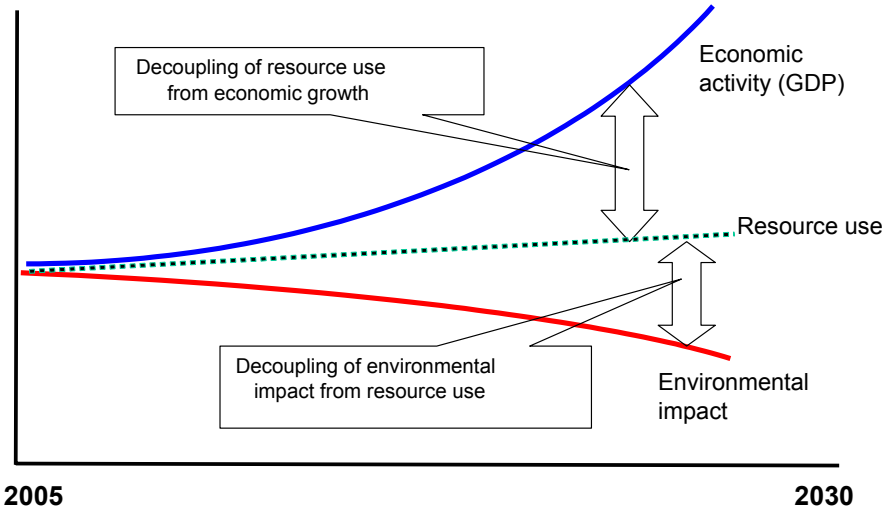
Figure 8.2. Delivering the 6EAP



Source: own

Resource Strategy contains challenges and sets a wide framework for action to manage natural resources. In Figure 8.3. vision of the Resource Strategy in the future by 2030 is shown. Waste Strategy combines waste policy with wider resources policy and sets long – term strategy (25 years) aims to move to recycling society. Main objectives of this strategy are decoupling of resource use from economic growth and decoupling of environmental impact from resource use. In order to achieve these goals we should build on existing policies, use life-cycle approach and create new initiatives i.e. building the knowledge base: Data Centre, measuring progress by using the indicators (for example: resource productivity Euro/kg).

Figure 8.3. Vision of the Resource Strategy



Source: http://ec.europa.eu/environment/waste/pdf/slides_stakeholder_meeting_0601.pdf

The main objectives of the Waste Strategy and Recycling of Waste are: modernisation of society by bringing new environmental thinking and behaviour into waste policy, clarifying and simplifying the regulatory environment, reinforcing the waste recycling market and implementing prevention policies.

Main Act and regulation of waste management in European Union:

- Decision No 1600/2002/EC of the European Parliament and of the Council of 22 July 2002 laying down the Sixth Community Environment Action Programme[284]
- Decision 2000/532/EC establishing a list of wastes[285]
- Regulation (EC) No 1013/2006 of the European Parliament and of the Council[286] of 14 June 2006 on shipments of waste.
- Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.[287]

[284] Decision No 1600/2002/EC of the European Parliament and of the Council of 22 July 2002 laying down the Sixth Community Environment Action Programme.

[285] This Decision establishes the classification system for wastes, including breakdown between hazardous and non-hazardous wastes.

[286] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006R1013&from=EN

[287] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. (OJ EC L 312, 22.11.2008, p. 3).

Decision No 1600/2002/EC

The Decision establishes a programme of Community action called "programme" in the field of environment. The programme identifies the key environmental objectives to be realized. Action and tasks correspond to the key environmental priorities in the following areas:

- climate change,
- nature and biodiversity,
- the environment, health and quality of life,
- natural resources and waste.

This programme includes the following main objectives:

- Climate protection within the next 10 years. This programme will determine the long-term objective of a maximum global temperature increase of 2°C above pre-industrial levels and a CO_2 concentration below 550 ppm. In the longer term this will require a global reduction of greenhouse gas emissions by 70% compared to 1990 levels, as has been identified by the Intergovernmental Panel on Climate Change (IPCC);
- Improving the quality of life and social well-being of citizens by providing an environment where the level of pollution does not give rise to harmful effects on human life;
- Better resource efficiency and resource and waste management.

The decision sets up a hierarchy of waste handling methods as follows:

- reducing the amount of waste going to disposal and the amount of hazardous waste and avoiding an increase of greenhouse gas emissions into the air and environmentally damaging substances going into the water and soil;
- encouraging the reuse of raw materials from waste;
- giving waste to recovery and especially to recycling;
- minimizing the amount of waste for disposal, and its safe removal.

Increase in the amount of waste from the production, distribution and consumption processes causes significant financial losses for the region and the state. This is due to the fact that the amount of waste generated per capita (generation rate) is closely correlated with factors such as:

- economic research (e.g. volume of consumption goods),
- Social (standard of living),

Therefore, the Member States should aim to separate the relationship between economic growth and the amount of waste generated.

The cost of waste is affected not only by its disposal cost, but also other factors that may affect the budget, such as: (Na koszt odpadów wpływa nie tylko ich utylizacja, ale również inne czynniki, które mogą mieć wpływ na budżet, takie jak:)

- the purchase price of the materials that have been wasted
- the costs of storage, transport and disposal of waste
- the cost of work time associated with the management and operation of waste
- loss of income due to non-recovery of materials from waste.

Decision 2000/532/EC[288]

This Decision has established a **list of wastes** and a classification system for wastes, including a distinction between hazardous and non-hazardous wastes. The list presented by the Directive is a harmonized list of wastes. This list will be periodically reviewed and if necessary, it will be modified.

The different types of wastes in the list are fully defined by the six-digit code for the waste and the respective two-digit and four-digit chapter headings. This means that in order to identify waste in the list we should take the following steps:

- the source generation should be identified in section 01-12 or 17-20,
- if the correct code cannot be found in sections 01-12 or 17-20, we should check chapters 13, 14 and 15 to identify the waste,
- If none of the above-mentioned waste codes is appropriate, the waste must be identified in accordance with Chapter 16,
- If the waste is also not included in Chapter 16, the 99 code must be used (waste not classified elsewhere).

Regulation (EC) No 1013/2006[289]

This Regulation specifies under which conditions waste can be shipped between countries.

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[288] 2000/532/EC: Commission Decision of 3 May 2000 replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste (notified under document number C(2000) 1147) (Text with EEA relevance).

[289] Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste.

The main and most important aim and objective of this Regulation is to protect the environment. The decision emphasizes the importance of organizing and regulating supervision and control of shipments of waste in a manner that takes into account the need to preserve, protect and improve the environment and human health.

Directive 2008/98/EC[290]

Directive 2008/98/EC includes the framework of waste management and obliges the Member States to develop waste management plans and waste prevention programmes. In compliance with these documents countries will be expected to describe existing prevention measures and to establish new methods of waste prevention.

It is because the control of waste generation is not sufficient. So, the most efficient way would be waste prevention that also contributes to:

- reducing the impact of waste management on the environment, e.g. development and implementation of a low-carbon action plan,
- more efficient use of natural resources,
- reducing the amount of hazardous waste generation,
- reducing the amount of waste deposited in landfills,
- elimination of wild landfills.

In order to achieve this objective the National Waste Management Plan should be developed. This plan should be consistent with the national environmental policy.

The most important obligations arising from the membership in the European Union are the following:

- recovery of the material where possible and recycling of packaging waste
- reducing the mass of deposited municipal biodegradable waste as compared to the mass of waste generated in 1995,
- collecting of waste batteries and portable accumulators,
- annual collection of waste electrical and electronic equipment (from households).

The National Waste Management plan should be indicate:

- short-term goals,
- medium-term goals,
- long – term goals.

[290] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:en:PDF

These goals may be achieved by the following actions:

- not connecting the amount of waste produced with economic growth of the country, (nie łączyć ilości produkowanych odpadów ze wzrostem gospodarczym kraju),
- increasing the recovery of the electricity from municipal waste (e.g., the development of biogas)
- the closure of all landfills that do not comply with the EU standards,
- ensuring land reclamation after closure of landfills, in a way which is safe for environment,
- an inventory of closed and abandoned mining waste landfills,
- segregation and proper disposal of waste electrical and electronic equipment,
- organizing a national system for collecting and dismantling of end-of life vehicles,
- the implementation of the pre-selection, sorting and recycling of municipal waste,
- environmental education and promotion of life with zero waste.

The National Waste Management Plan should involve all objectives included in tasks necessary to ensure integrated waste management in the country. Methods and tools which will be used, should guarantee environmental protection, taking into account present and future options for country or region and economic considerations, as well as the technological level of the national and regional infrastructure. The Plan should also reflect the trends in contemporary global economy, as well as considerations related to national and regional economic development.

This plan should include:

- a programme for waste prevention respectful of each type of waste,
- a strategy for reducing storing of biodegradable waste in the landfills.

The National Waste Management Plan may cover the following areas:

- identification of the current state of waste management on a national and regional scale, in particular information about e.g.:
  - waste subjected to the recovery or disposal processes,
  - holder of waste carrying out activities in the field of waste collection, recovery or disposal,
  - distribution of the existing facilities for waste collection, recovery or disposal,

- identification of other executive problems which are barriers for implementing of the Waste Management Plan,
- changes in waste generation and management,
- objectives for waste management with deadlines for their achievement,
- structure of waste management system,
- actions and a timetable for implementation of objectives,
- financial instruments for achieving the objectives,
- a monitoring system and a method of evaluating to assess the degree of implementation of a waste management plan in practise.

In order to develop a waste management plan, waste should be divided as follows:

- municipal waste,
- hazardous waste,
- other waste.

Derogations from the Act are the following documents:

- Regulation (EC) No **1446/2005**[291]. The United Kingdom and Austria are granted a derogation concerning waste statistics.
- Regulation (EC) No **784/2005**[292]. Lithuania, Poland and Sweden are granted a derogation concerning waste statistics.
- Regulation (EC) No **1829/2004**[293]. Belgium, Portugal, Greece and Cyprus are granted a derogation concerning waste statistics.
- Regulation (EC) No **317/2004**[294]**.** Austria, France and Luxembourg are granted a derogation concerning waste statistics.

Main document corresponding to waste in Poland are:

- Act of 27 April 2001 on waste (Dz.U. of 2010 No. 185, item 1243 and No. 203, item 1351)
- czy tu czegoś nie brakuje OF THE COUNCIL OF MINISTERS of 24 December 2010 on the "National Waste Management Plan 2014" (Monitor Polski of 31 December 2010).

Other documents relating to waste legislation in EU:

1. The challenge of transposing WEEE II into national law,
2. Directive 2012/19/EU on WEEE (Recast),

[291] Regulation (EC) No 1446/2005 [Official Journal L 229 of 6.9.2005].
[292] Regulation (EC) No 784/2005 [Official Journal L 131 of 25.5.2005].
[293] Regulation (EC) No 1829/2004 [Official Journal L 321 of 22.10.2004].
[294] Regulation (EC) No 317/2004 [Official Journal L 55 of 24.2.2004].

3. Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste,
4. Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste,
5. Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste
6. Council Directive 91/689/EEC of 12 December 1991 on hazardous waste
7. COM(2008) 397 final[295]
8. Recommendation 2001/331/EC of the European Parliament and of the Council of 4 April 2001,
9. Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006,
10. Council Directive 96/61/EC of 24 September 1996 – Council Directive concerning integrated pollution prevention and control.

Directive 2012/19/EU on WEEE (Recast) – This document introduces measures to protect the environment and human health. These activities are realized by preventing or reducing the adverse impacts of the generation and management of waste from waste electrical and electronic equipment (WEEE) and to improve the efficiency of such use.

COM(2008) 397 – The communicate includes information about the disposal of waste electrical and electronic equipment.

Recommendation 2001/331/EC – Recommendation applies to the minimum criteria for environmental inspections in the Member States.

Directive 2006/66/EC – This document establishes rules relating to prohibition of the placing on the market of batteries and accumulators containing dangerous substances and the detailed rules for the collection, treatment, recycling and disposal of waste.

Council Directive 96/61/EC – Council Directive concerning integrated pollution prevention and control.

8.3. Definition of waste

The principle of waste management: 'Who takes actions which cause or may cause the generation of waste, he should plan, design and conduct proper actions, so as to:

[295] Commission's Communication on the Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan, Brussels, 16.7.2008, COM(2008) 397 final.

- prevent waste generation and reduce the amount of waste and its negative environmental impact in the manufacturing of products, during their usage and after their period of duration,
- ensure compliance with the principles of environmental protection during waste recovery – in case of failing to prevent waste generation,
- provide conditions for safe disposal of waste (consistent with the principles of environmental protection) – in case of failing to prevent waste generation or of such waste which cannot be recovered.

Waste – means unsuitable substances and objects which the holder discards or intends to get rid of or is obliged to discard.

Waste management – focused activity for the collection, transport, recovery and disposal of waste, including the supervision of such operations and the cooperation with the staff of disposal sites, and including action taken as a dealer or broker.

According to Article 3 of Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives:

- **collection** – *"means the gathering of waste, including the preliminary sorting and preliminary storage of waste for the purposes of transport to a waste treatment facility"*
- **separate collection** – *"the collection where a waste stream is kept separately by type and nature so as to facilitate a specific treatment".*

Waste hierarchy definitions taken from article 3 of Directive 2008/98/EC are:

- **prevention** – *"measures taken before a substance, material or product has become waste,*
- **re-use –** *"any operation by which products or components that are not waste are used again for the same purpose for which they were conceived"*
- **treatment** – "*recovery or disposal operations, including preparation prior to recovery or disposal"*
- **recovery** – *"means any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy. Annex II sets out a non-exhaustive list of recovery operations",*
- **preparing for re-use** – *"checking, cleaning or repairing recovery operations, by which products or components of that have become waste are prepared so that they can be re-used without any other pre-processing",*

- **recycling** – *"any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations".*
- **disposal –** *"any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy".*

Waste management process may include the following phases:

- customers and waste separation sites,
- transportation,
- totally environmental waste facility,
- grading and maturing,
- compost distribution,
- product returns to the environment – recovery of the resources from waste.

Biodegradable waste – biodegradable waste comes from homes, gardens and allotments and is primarily plant debris (non-contaminated by pests and diseases) such as leaves, weeds, grass, straw, shredded stems and branches of plants and wood chips and waste timber. Bio-waste is also kitchen waste such as: peel of the fruits and vegetables, coffee grounds and tea, eggshells, and paper.

Municipal waste – non-industrial waste associated with a human activity and generated in a household. This type of waste is in the liquid or solid form.

Municipal biodegradable waste – waste includes materials e.g: paper, clothing and textiles made from natural materials (50%), waste from green areas, waste from kitchen and garden, waste of wood (50%), composite waste (40%), small fraction < 10 mm (30%).

Type of waste:

- municipal waste (waste including biodegradable waste),
- hazardous waste, (waste containing PCB, waste oils, waste from human or animal health care, used batteries and accumulators, waste electrical and electronic equipment, end-of life vehicles, waste containing asbestos, unnecessary combat assets and waste explosives, etc.),
- other waste (e.g. packaging waste, construction and demolition waste from buildings, etc.).

8.4. General information about waste management planning

The waste management in cities should reflect the waste management hierarchy, with waste prevention, waste refuse and recycling. During site clearance and reconstruction, there are opportunities for the beneficial reuse and recycling of the materials. The subsequent use of recycled materials in newly process of production also reduces the amount of waste which needs to be consigned from cities to landfill sites.

Waste management planning is an important element in a national, regional or local waste management policy. This plan presents an analysis of the current issue of waste. On this basis, a government sets out the objectives that must be met, formulates appropriate strategies and the necessary implementing measures.

The waste management plan should be read by everyone, who waste generation, such as:

- person, who produces waste,
- person, who holds, carries, keeps, treats or imports waste,
- dealers or brokers who have control of waste,
- persons, who are responsible for the transfer of waste.

The Waste management plan is obligatory for a Member State. The drawing up of waste management plans is required by Article 28 of the Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives[296]. Aims contained in the plan should be introduced by the regional or local authorities to regional or local plans.

National waste management plan should cover the entire geographical territory of a Member State and must comply with the provisions of Directive 2008/98/EC[297]:

- Article 1 (environment and human health protection by preventing or reducing the adverse impacts of the generation and management of waste and by reducing overall impact of resource use and improving the efficiency of such use),
- Article 4 – hierarchy of waste management,
- Article 13 – protection of human health and the environment,
- Article 16 – the principle of self-sufficiency and proximity.

[296] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:en:PDF

[297] Directive 2008/98/EC

Some of the basic principles of administrative waste planning:

- waste management plans should be reviewed at least every six years, and modified according to the needs.
- stakeholders and authorities and the general public should have the opportunity to participate in drawing up of the plans and have access to them when they are made. Plans should be placed on a publicly available website (in accordance with the Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 on public access to environmental information and repealing Council Directive 90/313/EEC – on the available information see Chapter Social participation).
- Member States must inform the European Commission about waste management plan, once adopted, and of any substantial revisions to the plans.

In order to assist national, regional and local authorities in the preparation of waste management plans in accordance with the requirements of the Directive 2008/98/EC, the Commission published the guidelines methodological note[298]. These guidelines allow the development of more coherent and appropriate practices in planning, in accordance with the requirements of the EU legislation.

8.5. Waste planning and management at a regional or municipal level

In order to fulfill the EU requirements in the field of waste management there should be implemented, for example, the following priority actions:

- the promotion of modern methods and techniques of waste management, in order to improve the eco-efficiency and the implementation of the sustainable use of raw materials, energy, water and other resources, their exploration and production;
- conducting scientific research, transfer of modern technology, the use of appropriate economic instruments and the development and implementation of indicators to measure resource efficiency;
- development and implementation of waste prevention and proper waste management,

[298] European Commission Directorate-General Environment, *Preparing a Waste Management Plan. A methodological guidance note*, Drafted by members of ETAGIW Consortium, 2012. http://ec.europa.eu/environment/waste/plans/pdf/2012_guidance_note.pdf

- development of a strategy on the recycling of waste, including measures aimed at ensuring resource separation, collection and recycling of priority waste streams; further development of producer responsibility; development and transfer of waste recycling and treatment technologies that are safe for humans and the environment.

In the Thematic Strategy on the prevention and recycling of waste – COM(2005) 666, attention was drawn to promoting sustainable use of resources. The strategy points to the need to take action promoting waste prevention, recycling and re-use in such a way as to produce the optimum reduction in the impact on natural resources. In addition, one of the objectives of the strategy is to cause a change in behaviour of the society in terms of waste management, in order to achieve high levels of recycling.

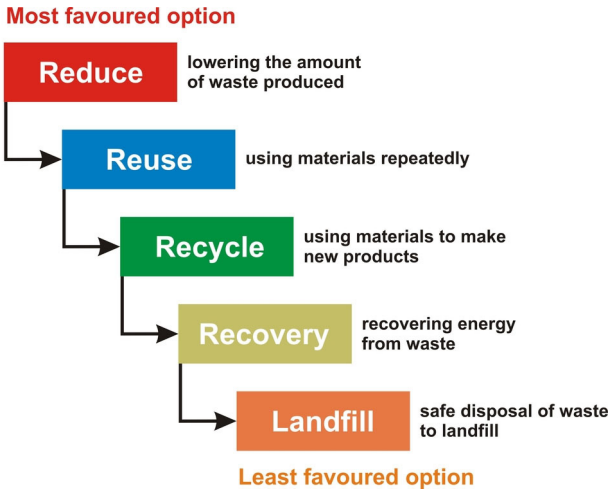
Waste management planning on the regional level requires the identification of key waste fractions, which are: packaging waste, municipal waste, waste electrical and electronic equipment, medical waste, hazardous waste and end of life vehicles. This plan should define the detailed rules for waste management in the regional /municipality areas, taking into account the following issues:

- the waste hierarchy,
- the proximity principle,
- polluter pays' principle,
- detailed rules for dealing with individual waste fractions,
- the obligations for the achievement levels of preparation for re-use.

In accordance with Article 4 of Directive 2008/98/EC, the Waste Hierarchy is as follow (Figure 8.4):

- reduce the amount of waste produced (prevention),
- re-use the material where possible,
- recycle the material where possible,
- recovery of any component parts or materials,
- disposal as the last resort.

Figure 8.4. The waste hierarchy



Source: http://consult.torridge.gov.uk/portal/planning/localplan/draft?pointId=s1354532716044

The proximity principle means that:

- waste in the first place should be treated as closely as possible to the place of its generation,
- waste that cannot be treated as closely as possible to the place of its generation, shall be submitted – having regard to the hierarchy of how to deal with management and best available technique or technology (BAT) – to the closest places where it can be processed,
- municipal waste should be processed in the regions waste management.

The polluter pays principle means that:

- the costs of waste management are covered by their producers, (na koszty zarządzania odpadami płacą ich producenci,)
- these costs are included in the price of product packaging, the price of the service receipt and processing of waste, or in the case of municipal waste as a fee to the municipality.

The levels of recycling means that:

- regional authorities have a statutory injunction to achieve certain levels of intensive waste management,
- environmental objectives in the municipality shall be determined according to the type of waste fractions.

The target level of recycling of packaging waste must be measured by an indicator and be determined to be achieved at a specified time, for example, the aggregated level of recycling of packaging should be achieved at the level of 56% until 2016.

Waste packaging

Tasks relating to the fraction of the waste should be charged to operators who launch packaging on the market. The Seller of products in packaging shall be obliged to:

- to incur the costs of the introduction of packaged products on the market,
- use packaging with specific characteristics,
- ensure the achievement of specified levels of recycling and recovery of waste packaging

Tasks of managing packaging waste may be performed independently or through a recovery organization.

Municipal waste

As part of the municipal waste management system there is also collected waste generated by the property owners, packaging waste, waste electrical and electronic equipment, batteries, battery, and waste from repairs.

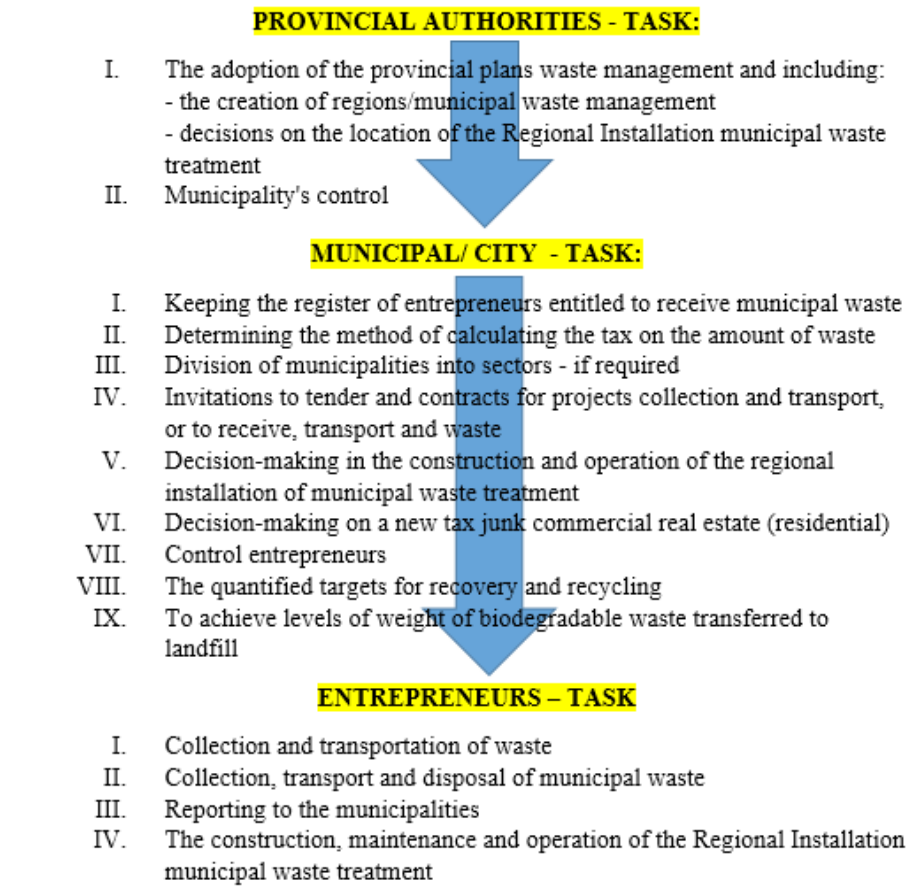
Example of the competence in the central municipal waste management is shown in Figure 8.5.

The functioning of the system in terms of collection and transport of municipal waste is shown in Figure 8.6.

The activities associated with the effective management and planning of waste in the areas of municipalities should consist of three phases:

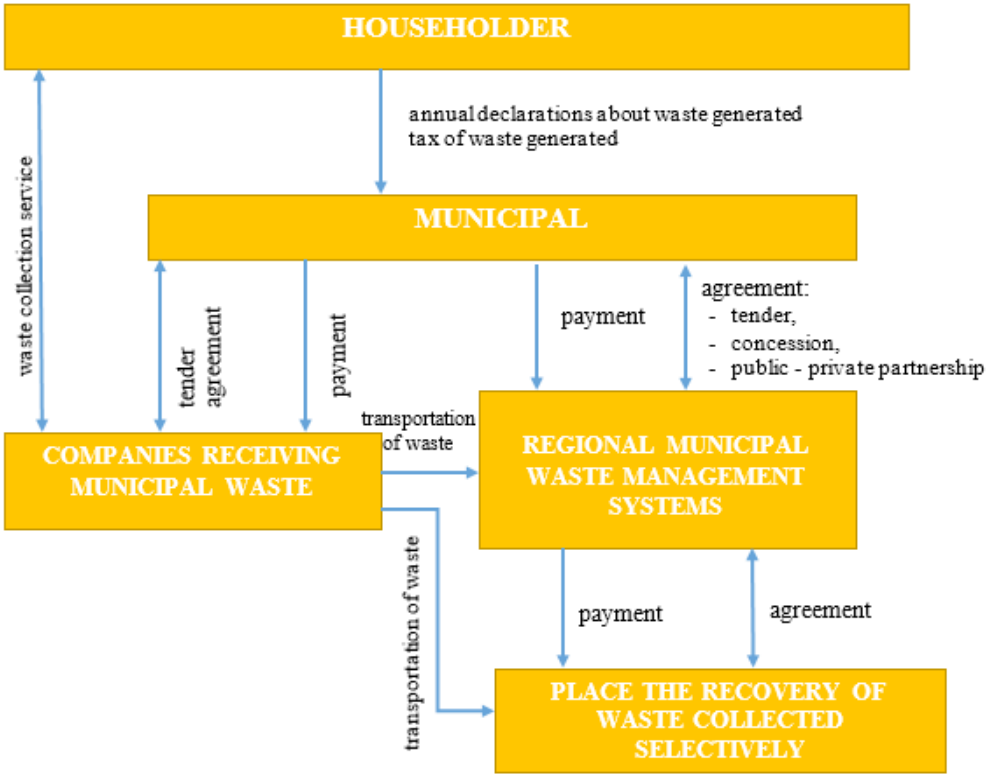
- Phase I: Pre-event action of waste,
- Phase II: In-event action of waste,
- Phase III: Post-event action of waste.

Figure 8.5. Example of the competence in the central municipal waste management



Source: own.

Figure 8.6. The functioning of the system in terms of collection and transport of waste in Poland – example



Source: own.

Pre-event action of waste

This phase includes planning, contracting and training, as follows:

1. **Information about waste:**
   - resource planning for all events and performance.
   - identification of waste: determining the types of waste, the sources of their origin, where they can be provided and what type of action is the best in this case.
   - identifying the source of waste: Where does it come from? Who did it? What is it made of? What is it wrapped in? What happens to it then?
   - identifying ways to minimize waste: prevention is cheaper than disposal, identifying ways to reuse, recycle and compost before other disposal;

This information will help to determine what can be reduced and recycled.

2. **Determination of objectives:**
- setting up realistic and measurable objectives,
- taking into account the objectives included in the procurement contract specifications,
- these actions will allow to share the load between the entrepreneurs who are concerned with municipal waste collection;

3. **Determination of activities related to waste management:**
   - the involvement of all levels of the organization from the beginning, making sure that they have buy-in from senior management;

4. **Specyfying ways of action:**
   - partnership between the organizers, venues, contractors and suppliers,
   - determining the possibility of reuse;

5. **Information activities:**
   - to ascertain whether the people were told what was planned and what will be done (internal and external),
   - providing training and communication before the execution of work to engage its staff, suppliers and contractors.

These actions will ensure that the waste management system will be effective.

6. **Review of progress:**
   - providing reports at regular intervals-the ability to assess the achievement of the objectives,
   - replacement requirements (for waste management in the contract reporting – identification of what works and what does not in the future.

Phase II. In-event action of waste

The transition from phase I to the implementation of activities – Phase II. The waste is generated from participants, sponsors and staff.

Phase II includes the following actions:

1. **Selection of the necessary amount of human resources,**
2. **Key activities in this step include:**
   - information and communication society:
     - ensuring people know exactly what has to be done,
     - clearly labeled waste containers,
     - verification of the implementation of the principle of proximity,
     - allowing the provider to meet the requirements of the contract.

- checking the system:
  - making sure that the planned waste management systems are in place, e.g. waste containers are placed where waste is produced.
- Management:
  - cooperation with employees and contractors to ensure that the processes related to waste management are observed.
- Monitoring activities:
  - monitoring of waste management system in operation,
  - checking whether the system works,
  - enforcement of the provisions of the agreements;
- Verification and reporting progress.

Phase III. Post-event action of waste

This phase relates to the collection of data from phase II and the analysis and evaluation of the following actions:

- analysis of whether the goals have been achieved,
- identifying what works and what does not,
- analysis of the cost of activities,
- collecting good practices,
- optimization activities
- identifying future action.

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[2] Commission's Communication on the Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan, Brussels, 16.7.2008, COM(2008) 397 final.
[3] Commission Decision of 3 May 2000 replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste (notified under document number C(2000) 1147) (Text with EEA relevance).

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[5] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. (OJ EC L 312, 22.11.2008, p. 3).
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WWW

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