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## GREEN CITIES

### MIASTA ZIELONE

#### Abstract

The changes in the system of urbanization, initiated by research and the resulting designs at the turn of the 19<sup>th</sup> and 20<sup>th</sup> centuries, consisted 'consisted' implies there were no either kinds of changes, if you don't mean that, use 'included' and take out 'of' of increasing the share not sure what you mean by share in this context, might 'proportion' be better? of green areas in urban spaces. Actions aimed at improving the human urbanized living environment, induced by the U'Thant's report and subsequent international documents, now seem to have been a permanent development trend. Simultaneously, other actions may be observed, relating to the introduction of smart technology solutions into the urban area aimed primarily at focusing on the maximized use of urban space and additionally at sustainable development. Sometimes, the need for contact with the natural environment is the reason for seeking the direct experience of large areas of attractive natural environment. Hence, more and more often, the latest urban creations boast high quality spaces featuring perfectly organized and developed green areas.

*Keywords: city, urban areas, area of organized greenery, natural environment*

#### Streszczenie

Zapoczątkowane badaniami i projektami z przełomu XIX i XX wieku zmiany w systemie urbanizacji polegały na zwiększeniu udziału terenów zieleni w przestrzeniach zurbanizowanych. Wywołane raportami U'Thanta i późniejszymi dokumentami międzynarodowymi działania na rzecz poprawy zurbanizowanego środowiska życia człowieka na Ziemi wydaje się być już trwałym trendem rozwojowym. Równoległe obserwuje się inne działania związane z wprowadzaniem rozwiązań inteligentnych technologicznie w przestrzeń miasta, które, zmierzając do równoważenia rozwoju z jednej strony, zwracają uwagę przede wszystkim na oszczędność przestrzeni urbanizowanej, kiedy indziej potrzeba kontaktu z naturalnym środowiskiem jest przyczyną poszukiwań bezpośrednich relacji z dużymi powierzchniami atrakcyjnymi przyrodniczo. Stąd coraz częściej mamy możliwość obserwowania, w najnowszych kreacjach urbanistycznych, wysokiej jakości przestrzeni opartych na perfekcyjnie urządzonych i zagospodarowanych terenach zieleni.

*Słowa kluczowe: miasto, tereny zurbanizowane, tereny zieleni urządzonej, środowisko przyrodnicze*

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## 1. Introduction

Research carried out in Poland in the 70s into towns requiring special ecological protection, 'the green towns', was focusing on spa resorts or towns with the dominant recreational function<sup>1</sup>. At the same time in Europe, new towns or cities were being created that were characteristically designed to feature large proportions of green areas<sup>2</sup>. The efforts to improve the living conditions in big cities resulted in a significant increase in the proportion of organized green areas (mostly parks) in the subsequent plans drawn for big European cities in the 90s<sup>3</sup>.

Research and analysis to improve the quality of human living space, initiated at the turn of the 19<sup>th</sup> and 20<sup>th</sup> centuries, was continued in later years. International documents published at the beginning of the 70s<sup>4</sup>, were the basis for the further development of cities and their regions in compliance with the ideas of sustainable development and environment conservation.

At present, the trend of pro-ecological city creation and transformation also refers to the places which are striving not only to expand their green areas but also to apply the latest technologies for producing energy from natural sources, such as the wind or the sun, and introducing 'smart' solutions of various kinds in order to save energy. It seems therefore that the trend of environmentally friendly city growth is also strongly related to improving the quality of life in urban areas. All the time, newer and more technologically advanced designs of environmentally friendly and smart cities, where the inhabitants' living conditions are of primary importance, indicate new trends in the creation of towns and cities of various sizes in many parts of the world. Realizations of cities or urban complexes based on the latest technologies improving the quality of life in the city are often priority projects in which a city or region's authorities are involved financially and politically, and are also within the framework of public-private partnerships. The objects are subsequently used for marketing purposes.

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<sup>1</sup> For example, within the framework of the project C CPBP 04.10.11.02.05 Spatial conditions of natural environment protection and transformation as well as principles of functioning and spatial management in typical urban structures on the example of South-Eastern Poland. In the research into a group of towns requiring special ecological protection led by prof. Wanda Pencakowska, the author was studying the problems of Krynica, other towns that were also subjects of the research included Szczawnica and Zakopane.

<sup>2</sup> The towns in question are mostly the new towns in the Paris suburbia, such as: Melun Senart, Saint Quentin en Yvelin or Cergy Pontoise, the centre of the last one – in the bend of the Oise river – comprises huge areas of natural and organized greenery, and also the new city of Milton Keynes erected half-way between London and Birmingham. Milton Keynes is not half-way between London and Bristol.

<sup>3</sup> The author refers here first of all to the design of the city and region of Madrid of 1993, in which the area of municipal parks and other urban green areas have been extended, owing to which the ratio of green areas that was obtained equaled 49 m<sup>2</sup>/one inhabitant.

<sup>4</sup> Those were the U'Thant's Report of the 26th May 1969, The problems of human environment, resolution no 2390, as well as the subsequent UN conferences, e.g. (just to name the most important ones) Human Environment of 1972, and starting from 1976 – Habitat conferences, the Gro Harlem Brundtland's Report Our Common Future, until the Rio declaration of 1992 and other ones, which were its continuations. This doesn't seem to make sense.

## 2. The origins of research into green areas in cities

In his first research works<sup>5</sup> from the turn of the 19<sup>th</sup> and 20<sup>th</sup> centuries, Jean Claude Nicolas Forestier compiled a list in which he quoted how many inhabitants there were on average in various big cities per 1 hectare of park areas, comparing American and European cities.

The presented figures were as follows

Name of the city	Number of inhabitants per 1 hectare of park	The area of parks per 1 inhabitant in m <sup>2</sup>
Los Angeles	64.8	154.3
Boston	94.7	105.6
Saint Paul	202.7	49.3
Washington	206.4	48.5
San Francisco	214	46.7
Vienna	400	25.0
Saint Louis	575	17.4
Detroit	663.4	15.1
Philadelphia	799.7	12.5
Baltimore	872.1	11.4
New York	943.6	10.6
London	1031.5	9.7

After: J.C.N. Forestier, *op. cit.*, prepared by the author

In American cities, created mostly in the 19<sup>th</sup> century, green areas were considerably larger than in European cities, which had been developed from densely built-up Gothic cities and restricted in their territorial expansion by later fortifications.

According to research done in the centre of Cracow<sup>6</sup>, relating to selected towns and cities of various sizes in Małopolska, in the 19<sup>th</sup> century the area of parks per one inhabitant ranged from 1.36 m<sup>2</sup> to 21 m<sup>2</sup>, and was on average 5.3 m<sup>2</sup>.

Works undertaken in cities with the objective to improve their inhabitants' living standards resulted from criticism, voiced towards the end of the 19<sup>th</sup> century and directed at the way cities of that time had been developed. The criticism emphasized the poor hygienic conditions in the densely built-up urban areas, including the insufficient amount of greenery.

New ideas for building cities, initiated towards the end of the 19<sup>th</sup> century, resulted both from the critical review of the contemporary city (too densely built-up, with a poor transportation network and an insufficient number of parks or gardens that would be open for the public and an equally insufficient amount of sports areas and playgrounds for children)

<sup>5</sup> J.C.N. Forestier, *Grandes villes et systèmes des parcs*, Hachette, Paris 1908.

<sup>6</sup> After: B. Bartkiewicz, *Wpływ funkcji wypoczynku na kształtowanie przestrzeni miast*, Kraków 1985, 99.

and from the newly emerging socialist ideas<sup>7</sup>. In the designs of modernist cities, one of the important changes was the introduction of large green areas into the structure of the city<sup>8</sup>.

The problem of green areas in the city and its environs, considered as areas of recreational function, found a prominent place in the Athens Charter<sup>9</sup> – an international document developed by architects of socialist sympathies, which in the 2<sup>nd</sup> part of the 20<sup>th</sup> century, lay at the root of numerous urban solutions.

### 3. The sizes of arranged green areas in selected European cities in the first half of the 20<sup>th</sup> century

In the discussion on the sizes of green areas in larger European cities in the first half of the 20<sup>th</sup> century, it is worthwhile comparing these areas in some selected European cities.

In most cities in Germany, the sizes of green areas divided by the number of inhabitants gave the indicators ranging from 20.5 m<sup>2</sup> per one inhabitant to 30 m<sup>2</sup> per one inhabitant<sup>10</sup>.

According to J.C. Forestier, the size of green areas in a city with a population of around 1 million should be on average 50 m<sup>2</sup> per inhabitant, including 30 m<sup>2</sup> in the midtown area and the remaining part (20 m<sup>2</sup>) in the areas beyond the city centre.

The concept of Greater London provided for 28 m<sup>2</sup> of green areas per person<sup>11</sup>, and the concept of Manchester of 1946 stipulated the following:

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<sup>7</sup> The concept of a linear city by Soria y Mata, *Teoría de las ciudades lineales*, published in *El Progreso* – a daily newspaper in Madrid in 1882, and Ebenezer Howard's idea of a garden city, which came out in 1898 as *Tomorrow: a Peaceful Path to Real Reforms*; starting from 1902 the subsequent editions of this publication were entitled *Garden-cities of To-morrow*. One of the principles of the aforementioned concepts was combining the living conditions in the country, characterized by access to pristine nature, with living in the city.

<sup>8</sup> In his designs of a contemporary city, Le Corbusier adopted the principle of *Cité-jardin vertical*. In theoretical sketches of cities from 1923–1924, the plan Voisin and plan Radieuse provided for at least 50% of undeveloped areas appropriated for greenery.

<sup>9</sup> Some of the recorded postulates stated that in each city district, (there should be) a green space of appropriate size, with a playground and a sports area for children and adults, and have open-air swimming pools (...). Green areas should be used for establishing kindergartens and gardens for children, erecting schools and other public utility buildings (...). The city should provide a sufficient amount of green areas appropriated for generally accessible places of recreation in the form of parks, squares, sports stadiums, beaches etc. Suitable natural conditions should be made use of by arranging those places for the purposes of recreation.

<sup>10</sup> E.g. in 1939 there were 32.9 m<sup>2</sup> per one inhabitant in Breslau. After: A. Ptaszycka, *Przestrzenie zielone w miastach*, Poznań 1950.

<sup>11</sup> The concept authored by Sir Patrick Abercrombie and J.F. Foeshaw, which was passed in 1955, stipulated breaking down these areas in the following way: 16 m<sup>2</sup> per inhabitant in the LCC area and the remaining 12 m<sup>2</sup> in the suburban area of Greater London. Finally, in the approved plan, 10 m<sup>2</sup>/inhabitant was stipulated, yet the objective of 16 m<sup>2</sup> per inhabitant was still preserved and remained an aspiration.

- 22.4 m<sup>2</sup> per inhabitant in newly designed districts,
- 14.4 m<sup>2</sup> per inhabitant in the existing development of medium density,
- 10.4 m<sup>2</sup> per inhabitant in the existing development of high density.

At the same time, the ratio of 32 m<sup>2</sup> per inhabitant was adopted in the “unit neighbourhood” and 16 m<sup>2</sup> per inhabitant in the city composed of five neighbourhood units.

European analyses of the years 1930–1950 stipulated that there should be from 9% to 35% of the city area appropriated for open spaces depending on the size of the city, and in France, it was at least 25%, following the research by Forestier.

The figures quoted by Polish researchers at that time were almost uniform and remained in the range of around 30 m<sup>2</sup> per inhabitant. Minimum figures, however, did not take into account all kinds of green areas<sup>12</sup>.

The sizes of green areas partly depended on the size and function of the city. In the development plan for Warsaw of 1938<sup>13</sup>, the size of green areas stipulated per one inhabitant was 32.7 m<sup>2</sup>, while in the existing conditions, the area was 6.78 m<sup>2</sup> per one inhabitant – the city had 1 261 000 inhabitants.

#### **In other Polish big cities, the sizes of green areas were as follows**

Name of the city	Year	Number of inhabitants	Green areas ration
Łódź	1938	665 000	10.58 m <sup>2</sup> per inhabitant
Poznań	1939	250 000	68.00 m <sup>2</sup> per inhabitant <sup>1</sup>
Białystok	1939	100 000	20.00 m <sup>2</sup> per inhabitant

After the Second World War, in the city plan of 1949 drawn at the Capital Reconstruction Office, following the Soviet standards, the ratios in Poland were as follows:

- 47 m<sup>2</sup> of green areas per inhabitant on the scale of the whole city,
- 30 m<sup>2</sup> per inhabitant on the scale of a housing estate.

In subsequent years, the urban planning standard in our country was subject to several changes and modifications, and on each occasion, the green area ratio was reduced<sup>14</sup>.

#### **4. First European city designs and realizations with a high proportion of biologically active areas**

Towards the end of the 60s, there was a growing awareness that it is necessary to introduce more green areas into European cities. The first such designs were created even before the

<sup>12</sup> The following types of areas were differentiated for urban settlements: physical education areas (e.g. gardens with play areas for children and shooting parks); allotment gardens; recreational units, such as parks and plazas of the area of 3 m<sup>2</sup> per inhabitant; suburban forests – 13 m<sup>2</sup> per inhabitant; cemeteries – 4 m<sup>2</sup> per inhabitant.

<sup>13</sup> After: T. Tołwiński, *Urbanistyka*, Warsaw 1963.

<sup>14</sup> In the 50s, the green area ratio was, according to Polish standards, 15.5–25 m<sup>2</sup> of arranged greenery in a city per one inhabitant, in the 60s the ratio was only 11 m<sup>2</sup> of biologically active area per inhabitant, including a minimum of 6 m<sup>2</sup> of compact greenery per inhabitant and 3.5 m<sup>2</sup> of park greenery per inhabitant.

well-known U'Thant's reports came out. One of the first cities constructed from the beginning as a complex with a high proportion of green areas is Milton Keynes, a city situated at equal distances from the capital of the country, Birmingham, Leicester, Oxford and Cambridge – it is over 77 km to the north-west of London<sup>15</sup>.

The town was initially planned for a population of 50 thousand<sup>16</sup>, and the planners used the layout of grid squares with sides approximately 0.7 km long, and all the intersections were built in the form of small roundabouts. One of the town's primary design principles was the absence of a hierarchical system of services, which were to be distributed evenly throughout the whole complex – hence there is no urban services centre. Another guideline was a complete segregation of pedestrian and vehicle traffic, 200 km of cycling lanes and pedestrian walkways had been designed in the town to achieve this objective. The town was built as an environmentally friendly complex, and approximately 1.116 ha were initially appropriated for green areas. At present, open green areas cover approximately 3.000 ha of land<sup>17</sup>. The height of the buildings was also restricted – they were not to be taller than the tallest trees<sup>18</sup>. Closing some of the collision-free pedestrian crossings has also been observed, and there are suggestions to increase the development density.

At the same time, the design of five sub-Parisian towns started to be realized within the framework of the Paris development, where the amount of green areas was to be considerably higher than in the centre of the metropolis<sup>19</sup>. From this point of view, the town of Cergy Pointoise turned out to be the most characteristic. Located in the bend of the river Oise, the central parts of the town are green areas accompanying the water reservoirs, mostly of a recreation function.

The first technological city, Sophia-Antipolis<sup>20</sup>, built in the years 1970–1984 in the south of France, between Cannes and Nice, is populated by approximately 30 thousand inhabitants. The International Technology Park Valbonnes Sophia-Antipolis was created here at the beginning of the 70s. At the beginning of the 90s, a new territorial unit was formed, the Sophia-Antipolis Agglomeration, which comprised fourteen little neighbouring historic towns<sup>21</sup>. Complexes of the new amorphous development were inserted into the partly developed and partly arranged natural stone pine forest<sup>22</sup>. The standard for green areas

<sup>15</sup> The decision to build the city was taken at the beginning of 1967 – it was to be situated in rural areas, where the population at that time was a little over 20 thousand. The design stipulated for the city to be inhabited by 250 thousand people in an area of almost 90 km<sup>2</sup>.

<sup>16</sup> In 2007, the population was 228 thousand, and it is prognosticated that in the course of the next 25–30 years, the number will rise to 370 thousand. After: Milton Keynes Open Space Strategy 2007.

<sup>17</sup> In 2007, open spaces covered 1.200 ha, parks – 1.800 ha, forests open to the public – 250 ha, and additionally, the town has 60 km of trails along rivers and streams, 200 km of walkways and cycling lanes. After: *Ibidem*, 7-9.

<sup>18</sup> In the first decade of the 21st century, the original restriction was lifted due to the pressure exerted by various entities, and two high-rise buildings were admitted.

<sup>19</sup> The ratio of green areas in midtown Paris at that time was approximately 10% of the city area, while in the sub-Parisian towns, the minimum amount of green areas was 33% of the total area of the town.

<sup>20</sup> Of the area of approximately 25 km<sup>2</sup>, equal to 1/4 of the area of Paris, the town has 1260 businesses in operation, employing 25 911 people (data as of January 2011), Université de Nice-Sophia Antipolis, seated here, employs 1440 faculty staff and provides education for 26 thousand students.

<sup>21</sup> After: M. Wdowiarz-Bilska, *Technopolia w mieście – nowe modele urbanizacji*, Technical Journal, issue 7/A/2007.

<sup>22</sup> After: M. Wdowiarz-Bilska, *Ekologiczne aspekty funkcjonowania parków technologicznych*, Technical Journal, issue 2/A/2004, 199-204.

was determined in compliance with the Minister of the Environment Charter and stipulated preservation of 2/3 of the protected green areas and maintenance of the development in the areas appropriated for that purpose at the level of 30%<sup>23</sup>.

On the other hand, in Aix-en-Provence, the capital of Provence, at present one of the largest French technopolises, the ratio of green areas only of park character is 11.25 m<sup>2</sup> per inhabitant<sup>24</sup>.

## 5. Contemporary designs and realizations of green cities and green areas in cities

Since the end of the 20<sup>th</sup> century, works have been carried out in many European cities with the objective of increasing biologically active areas or arranged green areas.

Numerous plans of enlarging the existing green areas have been prepared for many of them.

The actions that have been undertaken with a view to achieving this aim may be classified in the following ways:

- enlarging park areas and arranged green areas in the city or in its environs,
- surrounding intensely urbanized areas with a strand of arranged green areas,
- introducing green areas to brownfield land, in the vicinity or over railway areas,
- using all possible surfaces in the city for the purpose of developing green areas,
- creating new cities with heightened ratios of green areas.

As a result of those diverse actions, the amount of land developed as green areas has significantly increased in many big cities in Europe and elsewhere in the world.

### Enlarging park areas and arranged green areas in the city or in its environs

Towards the end of the 20<sup>th</sup> century, Madrid has witnessed a significant increase in the amount of arranged green areas. The city plan provisions<sup>25</sup> stipulated that the number of parks in the area exceeding one hectare was to grow from three to seventeen, reaching a ratio of 11% of the total city area. At the same time, areas under legal protection in the metropolitan area were extended from 94.000 ha to 158.000 ha, which meant that they would constitute approximately 20% of the total area of the metropolis, and forested areas – up to approximately 53%<sup>26</sup>. Putting these plans into practice resulted in obtaining one of the highest ratios of arranged green areas per inhabitant in a big city, which is now 49.30 m<sup>2</sup>, and led to the declaration of Madrid as the greenest capital in Europe<sup>27</sup>.

The last 40 years in Paris on the other hand, have been marked by a rapid increase in the amount of green areas open to the public as gardens or parks. Approximately 40 new

<sup>23</sup> The appropriation of the town area is as follows: 150 ha for residential development for approximately 12 thousand people, 650 ha for services and industry for 26 thousand of employees, 1.500 ha – the arranged green areas – the Green Crown.

<sup>24</sup> It refers to parks of the area ranging from 5 ha to 180 ha.

<sup>25</sup> Plan regional de estrategia territorial Madrid (ed. J.H.E. Dominiguez), Comunidad de Madrid, Consjeria de Politica Territorial, Madrid 1995.

<sup>26</sup> Madrid Region Metropolitana. Estrategia Territorial y Actuaciones. Comunidad de Madrid 1991.

<sup>27</sup> The total amount of park areas in Madrid equals 3.300 ha. *Ibidem*.

complexes of greenery have been established during that period, half of them in the last 20 years. The areas of individual complexes range from a few hectares to a few acres<sup>28</sup>.

### **Surrounding intensely urbanized areas with a strand of arranged green areas**

Actions of this type are more and more popular in many cities. A green belt around urbanized areas gives their inhabitants an opportunity of relatively easy and direct contact with areas of natural greenery. In the late 60s, there was a concept of this kind for the Upper Silesian Industrial Region (*Górnośląski Okręg Przemysłowy*). The regional plan design marked out a forested protective belt around a group of more than ten Silesian cities<sup>29</sup>. The primary objective of the outlined strand was to create a buffer zone limiting the dispersion of air contamination created by industry in the agglomeration centre. The development design adapted the area for the purposes of recreation.

A completely different concept was the plan to create a green belt around Frankfurt am Main, created in 1989<sup>30</sup>. The designed area encompassed the parks and forests of the spa resorts located around Frankfurt, such as Bad Soden, Bad Vitbel and Bad Homburg, and fragments of the already arranged areas of NaturParken situated in the vicinity of the city. Joining these complexes by compact recreational green areas is of significant importance, not only from the point of view of recreation, but also for improving the climate and health conditions existing in Frankfurt.

### **Introducing green areas to brownfield land, in the vicinity or over railway areas**

Introducing arranged green areas into brownfield sites in large cities is best known from examples of successful realizations in Paris, where Parc La Villette, Parc de Bercy and Parc André Citroën have all been created on brownfield land. Nevertheless, in Paris as well, post-railway areas and areas over railway stations are used for creating complexes of greenery, for example Jardin Atlantique over the Montparnasse railway station lobby and platforms<sup>31</sup> or the several-kilometres long complex of La Promenade Plantée, situated along the route of the now defunct railway line from the Place de la Bastille to the Vincennes woods<sup>32</sup>, just to name a few.

An interesting solution is the latest decision of the Berlin authorities pertaining to the development of the Tempelhof airport<sup>33</sup>. Due to the construction of a big airport, Berlin-Brandenburg<sup>34</sup>, the airports that are now situated in the midtown zone, must take up some other functions. The Gatow airport, closed as the first, has been turned into a museum of

<sup>28</sup> 9 new complexes of the total area of 120 ha have been established in the area of midtown Paris since the 70s of the 20<sup>th</sup> century.

<sup>29</sup> The concept for developing a recreational forested protective belt around the USIR /GOP/, years 1968–1969; the authors: architects A. Armata, A. Dolhun, M. Dolhun, R. Jerga, and M.S. Skowronek. After: *Architektura* 11-12/1983, 35.

<sup>30</sup> The design Grün Gürtel – authors: Peter Lanz, Peter Lieser, Walter Prigge and Manfred Hegger, 1990/1991. After: U. Weilacher, *Syntax of Landscape*, Basel–Boston–Berlin 2008, 168-169.

<sup>31</sup> Jardin Atlantique, of the area of 3.4 ha, was designed by a team of architects: Brun, Penna and Schnizler, and opened for the public in 1994.

<sup>32</sup> La Promenade Plantée, 4.5 km long, was realized according to the plan by architect P. Mathieux and landscape architect J. Vergely.

<sup>33</sup> The Tempelhof airport was built in 1923 at a distance of 4 kilometres from the city centre. The airport building is a very beautiful example of modernist art of the 20s.

<sup>34</sup> The opening of the International Airport Berlin-Brandenburg is scheduled for October 2013.

aviation. The next one situated closest to the centre was the Tempelhof airport, which remained in operation until the end of October 2008. Several options for its use, especially types of development, prepared and presented in architectural contests, have not been accepted by the residents of the neighbouring districts, who started using the airfield for recreational purposes immediately after the airport had ceased its operations. The discussion on the Tempelhof final function engaged wide circles of the Berlin community, who decided in a referendum that the whole area of the airport should be turned into a recreational area.

In conclusion, the city authorities decided in 2010 to create a municipal park on a significant part of the airfield, which would be accessible around the clock free of charge<sup>35</sup>. The park will be the biggest green area in Berlin, bigger even than the currently existing Tiergarten.

### **Creating new cities with heightened ratios of green areas**

This activity refers to new cities designed and realized in regions developed on the basis of industries using advanced technologies and dedicated for a highly qualified workforce employed in those areas. Another reason for creating new settlements of heightened standards of green areas is prestige and the possibility of displaying the investors' financial capabilities. Such complexes are sometimes created for the purposes of recreation and relaxation.

Among the cities that have been erected for the needs of employees working in the sector of advanced technologies are, for example, the Shanghai satellite city, Lingang, planned for 800 thousand inhabitants, or the Korean city situated on the Yellow Sea coast, Songdo City in Incheon, whose erection was to bring prestige connected with its location in a region developed on the basis of advanced technologies. Realization of towns on artificial islands of various shapes along the coast of the United Arab Emirates has also been motivated by the issue of prestige. The towns have achieved a high ratio of green areas owing to artificial vegetation planting.

The construction of the Songdo New City, located at a distance of 35 km from Seoul, was started in the middle of the 90s. It was planned not only as an international trade centre and a site for knowledge-based technologies, but also as an environment-friendly centre of urban life. The area appropriated for the city construction had been in part, a restored contaminated land and partly an artificial island reclaimed from the sea, the latter has the area of 6 km<sup>2</sup>.

The construction of the city is scheduled to be completed in 2020 and its area is to be 53.26 km<sup>2</sup>. The city will accommodate 252 000 people, and 40% of its area is covered by parks. The largest of them, with the area of 0.4 km<sup>2</sup>, is modelled on New York's Central Park<sup>36</sup>.

The Shanghai satellite town of Lingang<sup>37</sup>, situated at a distance of 60 km from the metropolis, was initially planned for 300 thousand people, but in subsequent plans, the number grew and finally reached 800 thousand. The city was built at the tip of the peninsula between the rivers Yangtze and Qiantang on the Hangzhou Bay. A part of the city is situated on a polder reclaimed from the East China sea. The concept for the city plan makes direct references to Ebenezer Howard's garden city diagrams, whose inspiration is not repudiated by its authors. The concentric layout was focused on the round artificial lake with a circumference of 3 kilometres, surrounded by a promenade and beaches 9 kilometres long.

<sup>35</sup> The area of the park is to be 250 ha. However, the total area of the airport is 368 ha.

<sup>36</sup> Seok Chul Kim *Urban Dreams*, Seoul 2007, 254-311.

<sup>37</sup> Design of 2002, authored by von Gerkan, Marg and Partner.

The islands created on the lake have been designated for cultural and recreational functions. Services, administration and office developments are concentrated around the promenade, and they are separated from residential areas by another circle of park greenery 500 m wide and approximately 10 km long. Residential development complexes placed radially around the circumference are separated by triangular areas of arranged and natural greenery performing the functions of recreation and relaxation.

The total amount of green area accounts for 75% of the city area.

## **6. The latest concepts of green cities or significant projects involving green areas in city centres**

The cities of the latest generation are characterized by a high proportion of green areas, they are cities of sustainable development, where not only are healthy living conditions propagated but where it is common to use the latest environmentally friendly solutions for providing electricity, clean water and heating.

Sometimes, large amounts of green areas result from the fact that they are used for the location of equipment serving the purpose of environmentally friendly energy production.

The best example to illustrate this kind of solution is the currently realized Logroño-Montecorvo Eco City situated in the Spanish province of La Rioja<sup>38</sup>. The city occupies an area of 56 ha and is situated on two hills. Its residential development is to comprise 3000 flats, and together with the whole urban infrastructure, it will cover 10% of the area appropriated for the city. The remaining area will stay biologically active and is to be used for the needs of recreation as well as for energy production. The area of over 40 ha, i.e. 73% of the total city area, has been appropriated in the design for an eco-park, where recreational areas are interspersed with equipment for obtaining solar and wind energy, such as wind farms situated on the hill or solar farms with panels placed on the southern hill slopes.

Another city of the new generation which is to be realized in Europe is the Portuguese city PlanIT<sup>39</sup>, situated in the area called PlanIT Valley as a reference to Silicon Valley, approximately 30 km to the east of Porto, in the valley of the Sousa river. It is planned that the city will accommodate a population of approximately 220 thousand and will be built in a series of phases. The city plan has the shape of a 10-kilometre strand and is developed over the line of an underground railway. It is going to be made accessible from the outside by the existing railway line and the A4 motorway, to which the city is to be linked by the expressway A41.

A large number of sensors are planned to be installed, which will control various processes in the city, such as heating and ventilation in buildings, humidity, energy consumption etc. The information will be sent to the control centre in order to activate photovoltaic cells or wind turbines, supply utility and drinking water etc. All buildings will have roofs covered by vegetation for limiting heat loss and filtrating rainwater. Buildings of a hexagonal plan will

<sup>38</sup> The design by the Dutch company MVRDV and the Spanish architectural studio Gras won the first prize in the 2008 contest for the design of this city. The whole project is to cost 388 euros, 40 million of which are to be invested in renewable energy technologies.

<sup>39</sup> The author of this design is Steven Lewis, a computer programmer formerly employed by Apple company.

be prefabricated in order to reduce the cost of their production. The park areas will feature a series of lagoons overgrown with bamboo, reeds and other plants, which will perform the function of natural filters filtering sewage in order to obtain 'grey water' used to flush toilets and for irrigation. The plants are to be replaced periodically, and the deposited vegetation, together with waste products, will be used as biomass for heating. In practice, the amount of green areas is to be completely balanced owing to the fact that all flat surfaces will be covered with vegetation and the amount of paved roads will be significantly limited.

Such solutions are considerably more numerous outside Europe. The most universally known is the city of Masdar built in the desert in the United Arab Emirates<sup>40</sup>, which houses a technology park established for solving important technical problems connected with city functioning, first of all with producing energy from renewable sources, water desalination, building zero-energy houses etc. The city was planned for 40–50 thousand inhabitants and additionally 60 thousand users of its spaces commuting daily from outside. Green areas established in the city and around it are both areas used for obtaining energy from biomass and vast plantations of trees used as primary building material.

Designed by the same team<sup>41</sup>, the Incheon new city, self-sufficient in terms of energy, will be the epicentre for the development of green technologies in South Korea.

The development will be home to over 320 000 residents, and the residential areas will be centered around a spine of transportation and the advanced technologies industry area. Therefore the spatial layout design of the city, which is to become the research and development centre for next-generation green technologies, uses the strand concept. The area designated for the development is now of agricultural character, and for minimizing the loss of agricultural space, all buildings will have green roofs so as to make hydroponic farming possible. According to the designers' plan, the amount of green areas will not change. Buildings are to be heated using energy generated from biomass or hydrogen fuel cells. The height of the buildings should not exceed 50 m. The construction process is scheduled for the next 10–15 years.

35 km to the south of Seoul, another development is being built, the Gwanggyo Power Centre designed by the MVRDV studio, which was supposed to have been ready in 2011. It is a complex of pyramids covered with vegetation, which house offices, flats, cinemas, shops, schools, hospitals and car parks. Owing to the compact structure of the buildings, the prognosticated 77 thousand inhabitants are to be squeezed on an area of 64 ha, and the terrace arrangement of buildings will provide access to light and air for everybody.

**Concepts of significant extension of green areas in the city** supply an important argument in the on-going discussion on improving the living conditions in the city. It seems that the best example of such actions is the contest of 2008 known as Paris 2030. 10 well-known architects or architectural teams were invited to participate in the contest<sup>42</sup>. One of

<sup>40</sup> The city, designed by Norman Foster's architectural studio (Foster & Partners), is being built on the initiative undertaken in 2006 by Emir Abu Zabi. After: MIT. Abu Dhabi Future Energy Company sign cooperative agreement. MIT.com News Office, 26<sup>th</sup> February 2007. Retrieved 10<sup>th</sup> May 2008.

<sup>41</sup> Foster & Partners, after: Eco Factor: Sustainable City to be developed by Foster + Partners; <http://www.ecofriend.com>.

<sup>42</sup> Sir Richard Rogers with his team, Yves Lion with the Descartes Group, Djamel Klouche with the AUC team, Christian de Potzamparc with his team, Antoine Grumbach with his team, Jean Nouvel with his team, Michel Cantal-Dupart/Jean M. Duthilleul, Bernardo Secchi with his team, Roland Castro with his team, Winy Maas and MVRDV.

the principles of the contest was to increase the ratio of green areas in the city to minimum of 30%. Many designs proposed various options for obtaining biologically active areas both on the surface of the ground and on the horizontal as well as the vertical surfaces of buildings. Even now, the solution of covering vertical elevations of residential buildings with vegetation has been used in the revitalized district of Massy on the Seine or at the rebuilding of the Austerlitz railway station. In its contest entry design, Richard Roger's team proposed an interesting concept of creating 'green boulevards' on the roofs of Paris, thus obtaining 400 km<sup>2</sup> of arranged green areas.

### **Using all possible surfaces in the city for the purpose of developing green areas**

Improving the living conditions in many cities is related to increasing the amount of biologically active areas, especially midtown arranged green areas. More and more ideas relate to this issue, mostly due to the new technological and structural possibilities.

A redevelopment plan for Garak-dong<sup>43</sup>, the largest food market in Seoul, envisions covering the whole market area with a landscaped roof that would form a municipal park connected to the ground level by a series of green ramps. Several storeys of car parks and retail areas will be accommodated under the roof.

A similar principle guided the design of the transit bus station roof in San Francisco<sup>44</sup>. The design envisions a glass tower connected with the surface of the terminal roof landscaped as a municipal park of an area equal to five and a half hectares. The aim of the design is to combine the function of transportation with the valuable social space of the park. The design is considered futuristic in terms of technology. Both buildings, the tower and the railway terminal, will be equipped with facilities for collecting rainwater and recycling grey water, wind turbines and geothermal heating and cooling. The essence of the design is its educational aspect for the strategy of sustainable development and ecology for everyone. The completion of the project is scheduled for 2014.

A very interesting design is one of the latest solutions for the centre of the Chongqing city in China<sup>45</sup>. The design for developing the city<sup>46</sup> was awarded at the Venice Biennale in 2006. The design proposes to create a whole city centre, called the Magic Mountains, composed of buildings of various sizes, with glass facades and multi-storey roofs sloping at different angles. These objects will create a mountainous landscape resembling the natural topography of the area. The green 'roofs' will feature parks, walkways and cycling lanes. High peaks are to indicate the dense urban development, and the buildings will gradually become lower as they approach the peripheries, where the population density is lower, until they disperse completely in the green valleys, characteristic for this region.

Open green areas on building roofs will be the places where energy is generated, and they will also be equipped with waste water treatment systems. The designers claim that the

<sup>43</sup> The Garak Market in Seoul was opened in 1985 in the Songpa-Gu district. It has the area of over 54 ha (543.451 m<sup>2</sup>).

<sup>44</sup> The design for Green San Francisco Transbay Terminal was created by the Pelli Clarke Pelli Architects team in 2007.

<sup>45</sup> The Chongqing municipality, the largest in the world, is undergoing rapid urban development. Every year, the floor area is extended by 50.000.000 m<sup>2</sup>, 500 km of motorways are built and the city accommodates 1 200 000 new inhabitants and urban space users.

<sup>46</sup> Authored by the Danish team MVRDV and CEBO/Chongqing University team (Danish/Chinese collaboration).

energy-efficient structure of the mountain may reduce the total energy consumption by 22% and substitute at least 11% of conventionally generated energy with energy from renewable sources.

## 7. Conclusions

The efforts aimed at improving the quality of life in the city, which have been undertaken for over a century now, have become more and more important when viewed from the perspective of demographic prognoses claiming that in less than 40 years 75% of the world's population will live in urban environments. What is more, improving the hygienic and sanitary conditions in cities, which involves increasing the amount of green areas, is becoming a priority which is perfectly understood not only by experts and designers, but also by urban communities.

Various kinds of legislative initiatives, implemented by international assemblies and organizations since the 70s, have permanently introduced the issues of sustainable development and natural environment conservation into the orbit of political, urban planning and design activities.

Numerous concepts tested and implemented in design solutions give evidence to the technical capabilities of creating biologically active areas in highly urbanized areas. Such designs very often apply cutting-edge technological solutions resulting from specialist research.

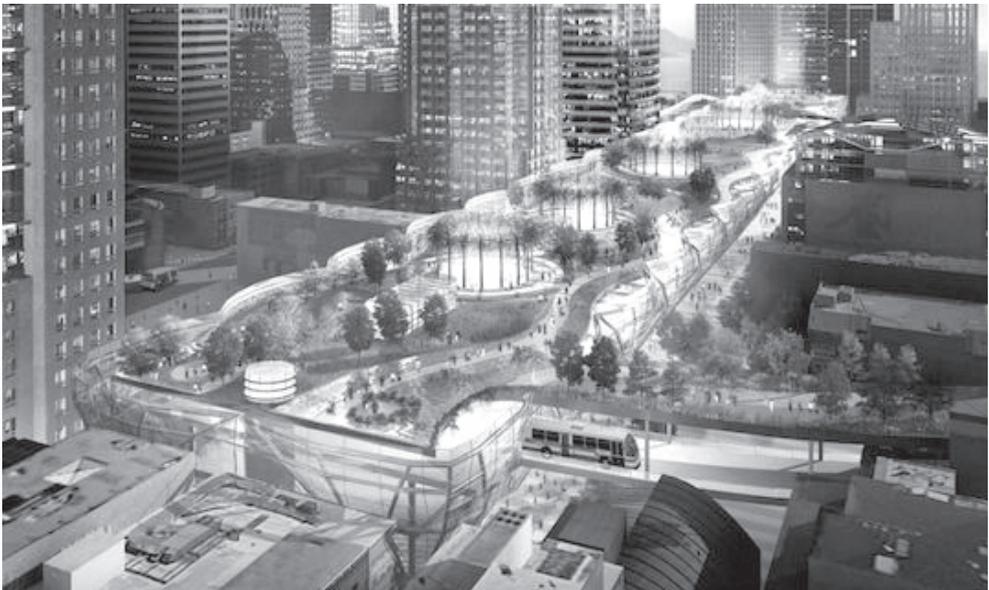
The number of design teams that are vividly interested in working on the so-called environment-friendly projects is visibly growing, and introducing green areas into urban spaces is increasingly perceived as creative and conceptual work. Hence, a lot of solutions related to green area design not only make use of the latest technological achievements, but they also present high intellectual and artistic values. Frequently, they become very attractive public spaces used for marketing purposes by the companies who supplied the equipment that has been used in the project as well as by the city authorities.

Simultaneously, the social awareness of the need for direct contact with natural or the arranged green environment is visibly growing.

It may seem surprising that the ideograms of cities from a hundred years ago, e.g. Ebenezer Howard's garden city and Arturo Soria y Mata's strand layout, have retained their appeal and do not feel outdated. It may not necessarily be a sign of their timeless value, but rather of the contemporary inclination to make references to experiences associated with environment conservation.



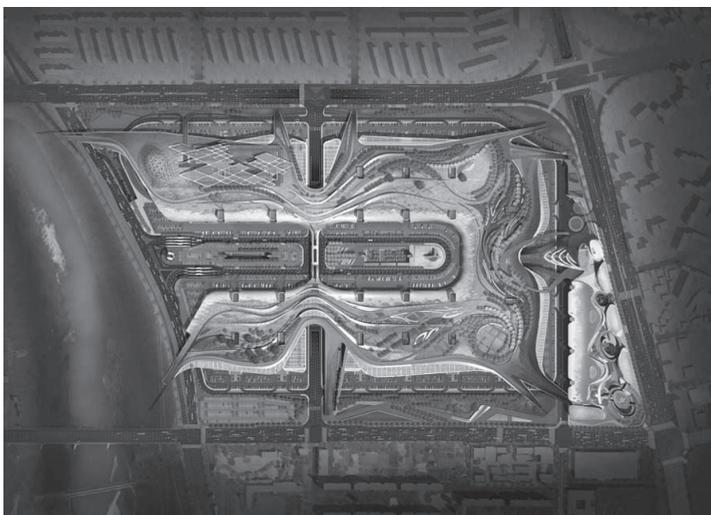
III. 1. Project of City Center in Chongqing in China by Danish Team MVRDV and Cebo-Chongqing University Team (source: [www.hetpublikationer.dk/UM/](http://www.hetpublikationer.dk/UM/))



III. 2. Transbay Terminal in San Francisco projected by Pelli Clarke Pelli Architects TEAM-2007. (source: [ad009cdnb.archdaily.net](http://ad009cdnb.archdaily.net))



Ill. 3. Project by Danish Team MVRDV near Kwangju, South Korea  
(source: [www.bryla.pl/bryla/1,85298,8079311,Eko\\_miasta](http://www.bryla.pl/bryla/1,85298,8079311,Eko_miasta))



Ill. 4. Garak Market in Seoul. Designed by Samoo Architects&Engineers  
(source: [inhabitat.com/garak-ed05/](http://inhabitat.com/garak-ed05/))



III. 5. Masterplan of Dabul Incheon projected by Foster+Partners and Pain&Mobility-Chain 2009  
(source: [www.archicentral.com](http://www.archicentral.com))