

# **THE IMPLEMENTATION OF THE PRINCIPLES OF SUSTAINABLE DEVELOPMENT IN THE RESIDENTIAL BUILDINGS OF BIG HOUSING ESTATES FROM THE SOCIALIST PERIOD**

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## **Summary**

Multi-family residential buildings, built in the socialist countries in the years 1960–1990 were not designed basing on the concept of sustainable development. Built under specific political and economic conditions, mainly in the concrete slab technology, using low-quality construction materials, full of technical defects resulting from the hasty construction process forced by the pressure of the authorities, they do not meet the expectations for the pattern of today's sustainable buildings. The only criterion for sustainability, which the large housing developments of the socialist period can be proud of is social sustainability, as the flats were settled and are today inhabited by social groups of different age, different level of education and with different incomes. Now, after the transition period, the buildings are subject to a number of works to adjust them to current legal requirements and new standards. Building owners and managers make an effort to raise their technical and functional quality, improve the external walls thermal insulation, replace worn out elements, reduce heating costs and power consumption, introduce new technologies to improve the environmental and economic parameters relating to the buildings.

Surveys and studies were performed at the Faculty of Architecture of the Technical University of Silesia in the Polish-German interdisciplinary research project entitled: “The past, present and future of Polish and German big housing estates. Comparative study of urban development models and their approval – examples of Katowice and Leipzig”. The group of sociologists and architects made a comparative study of the large housing estate in Leipzig-Grünau and three multi-family housing estates in Katowice. Using research tools: survey and in-depth interviews with residents, focus meetings with the settlements' designers, representatives of the local authorities and local actors that influence the investment process, as well as expert analysis of the buildings and surroundings, disadvantages, advantages and possibilities of development of settlements were examined thoroughly basing on the sustainable development triad of economics-ecology-society.

**Keywords:** housing estates, multi-family buildings

## **1 Introduction**

The postulate of Sustainable Development, a process aimed at satisfying the needs of our generation in a manner that enables the fulfilment of the needs of future generations [1], has become an important civilization concept in Europe in the last twenty years. Civil engineering and construction business are very strongly connected with the Sustainable

Development concept in view of their substantial impact on the environment: handling huge quantities of matter, consuming energy, evoking changes in the landscape and local ecosystems. Pursuant to the sustainability concept, buildings should be designed, constructed, used and demolished in accordance with the following principles:

- Minimization of the consumption of energy and materials, and minimization of environmental impacts (Reduce);
- Reuse of the resources (Reuse);
- Recovery of materials by means of recycling, designing buildings in consideration of the recovery of construction materials (Recycle);
- Using energy from natural sources and renewable sources, making building elements from renewable materials (Renewable).

Large-scale multi-family housing is a specific category of construction- not only interfering into the urban landscape but also, as it involves large populations of inhabitants, engaging and regulating social issues and cultural capital of a given city part. Hence, it is really important that multi-family houses are sustainable in consideration of all of the above-mentioned aspects.

Large multi-housing estates of the second part of the 20th century and constructed in pre-fabricated, slab ferroconcrete technology were designed at the times when the Sustainable Development concept was not recognized. The priority was to provide big quantities of flats in a possibly shortest time, often at the expense of quality and disregard for: architectural culture, aesthetics of form and finishing touches, while squandering raw materials and energy [2, 3]. The costs of maintaining buildings were not considered in the design process, the main focus being only on pure fulfillment of spatial and technical requirements. Currently, after over 30 years of their functioning, in the face of rigid energy standards and new building standards, the estates are stigmatized, especially in Post-Communist countries, as they are treated as painful relicts of the discreditable past. Nevertheless, they still provide habitation for thousands of occupants and it is hardly possible to replace these structures in a short time. Administrators and owners of such buildings undertake many efforts to adjust them to the present-day regulations, and detailed studies indicate that the buildings are not as bad as their perceived image propagated by the media and public opinion. In-depth analyses prove that large housing estates dating back to the late 20<sup>th</sup> century show certain aspects of sustainability and some other features that may be subject of improvement to meet the standard of sustainability.

## **2 LHE – Large Housing Estates Research Project**

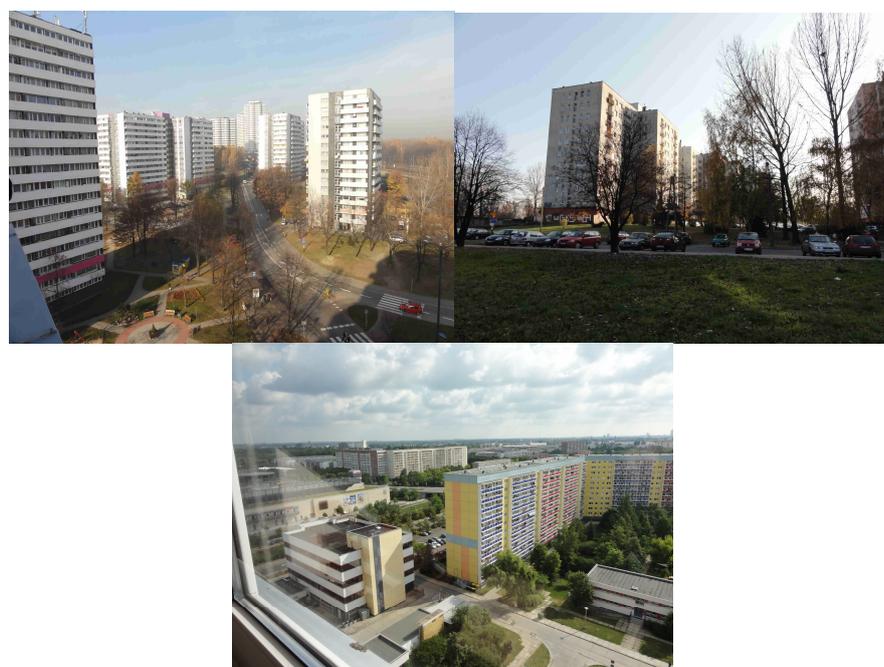
In 2011–2012, within the framework of the grants awarded by the Polish-German Foundation for Science, a joint research project was undertaken at the Faculty of Architecture, Silesian University of Technology, supervised by Professor Elżbieta Niezabitowska (the research team: Bartoszek A., Komar B., Kucharczyk-Brus B., Niezabitowski M., 2011–2012), in cooperation with Professor Sigrun Kabisch and the research team (Haase A., Grossman K., 2011–2012) representing the Helmholtz' Centre for Environmental Studies in Leipzig. The scope of the interdisciplinary studies: architectural, urban, sociological, was to compare large housing estates constructed in the second half of the 20<sup>th</sup> century in Katowice (Tysiąclecie, Paderewski and Zgrzebniok estates) and in Leipzig (Leipzig-Grünau estate). Expert analyses of the urban and architectural quality of the said estates were supplemented by surveys and in-depth interview with occupants and

administrators of the estates. The Polish research team surveyed 589 occupants of three selected housing estates (400 surveys were conducted at Tysiaclecie estate, 154 at Paderewski estate and 35 at Zgrzebniok estate) and collected information from 86 in-depth interviews. The derived data made it possible to identify the strengths and weaknesses of the investigated estates, create scenarios of their further development and supplied materials for the analyses determining the extent to which the estates and their buildings comply with the modern principles of Sustainable Development.

**Tab. 1** General data on the estates selected for the research

Basic data	Grünau	Tysiaclecie	Paderewski	Zgrzebniok
Date of construction	1979–1986	1961–2000	1973–1981	1979–2003
Surface area in hectares	About 500	188	35 ( including 25 hectares owned by Paderewski Housing Coop.)	25 ha ( including 11.2 hectares owned by the Katowice Housing Coop.)
Current number of occupants (as of 2011)	45 400 (2009)	22 868 registered	9 306 registered	1 457 registered
Density of the settlements (built area / ha)	994 m <sup>2</sup> /ha	862 m <sup>2</sup> /ha	1877 m <sup>2</sup> /ha	946** m <sup>2</sup> /ha
Density of population	about 91 persons/ha	about 122 persons/ha	about 266 persons/ha	about 130** persons/ha
Intensity of housing settlements (floor area/ha)	about 3400 m <sup>2</sup> /ha	about 2870 m <sup>2</sup> /ha	about 5860 m <sup>2</sup> /ha	about 4020** m <sup>2</sup> /ha

\*\*only multi-family blocks of flats owned by the Katowice Housing Cooperative in relation to the entire area under its management



**Fig. 1** Katowice Tysiaclecie and Paderewski, and Leipzig-Grünau estates scenery

### **3 Ecological sustainability**

The housing estates situated in Katowice and selected for the studies were constructed in the vicinity of the city centre, and are somewhat embedded in the urban landscape. High intensity of settlements at Tysiąclecie and Paderewski estates is compensated by the neighborhood of urban recreation green areas. Each of the investigated estates has a specific urban layout designed in consideration of the greenery, recreation sites, leisure activities for children and adults. The investigated estates date back to the times when urban design standards stipulated specific proportions of green and recreation sites in relation to the number of occupants, unlike current practices of commercial developers.

The urban layout of Tysiąclecie estate is based on the city-garden concept, i.e. situating tall houses in the “sea” of green, to continue, to a certain extent, the neighbouring recreation green complex: Silesian Culture and Leisure Park. The streets in the estate follow the land contours, making up a compliant, almost free composition resembling the system of park paths. They entangle the estate site with bigger and smaller loops, dividing it and comprising a communication scheme which, although attractive from bird’s eye view, is not very legible when perceived at the level of a pedestrian moving along the estate. Multi-family blocks of houses are embedded in the streets system, randomly situated at certain points, but all the facade balconies are east-west oriented. The buildings do not constitute compact systems, do not enclose space in settlement quarters, thus, they do not define the level of privacy of the adjacent land. The layout follows de Corbusier’s principle of open-plan urban design. Specific functions of particular sites are legible, although not clearly demarcated.

Paderewski estate was designed as a wedge-shape form, opening up towards the neighbouring recreation green complex. Recreation green was supposed to be drawn into the central part of the layout, and the houses to be situated at the two sides in a regular “comb-shaped” system. Road transport was designed outside the entire housing complex, whereas the internal zone was planned to be accessible for pedestrians only. The original design was implemented to a major extent, but, practical reality enforced the necessity of developing the central part of the estate otherwise: school and sport facilities, as well as administrative buildings were erected. Likewise, the road transport: all parts of the estate are now accessible by car, hence the designed gradation of space availability is not legible anymore.

The nest-like urban layout of multi-family buildings and terraced houses at Zgrzebniok estate in Katowice are surrounded by a lot of greenery (both trees and lower green) adding value to a specific climate and character of the entire site.

The image of Leipzig-Grünau estate does not seem really sustainable as it is vast and located at the peripheral zone of the city, close to the lake and rural open spaces. It is far more legible and sustainable perceived from its internal space. The estate comprises 500 ha, divided into several housing complexes (WK – Wohnkompleks), each having a different composition and separate spatial character. The houses are arranged into partially open quadrangles, so the inner yards may be entered through pedestrian gates and serve recreational and semi-private functions (for example: drying up the laundry, children playgrounds). These are solely pedestrian zones. In some larger quarters there are buildings housing services: nurseries, kindergartens. Car traffic and pedestrian traffic are organized in a collision-free manner. The entire estate area has no architectural barriers and is fully accessible to the disabled and cyclists [4].

Polish multi-family housing estates are faced with the problem of increasing number of cars and the ensuing demand for enlarging hardened pavements and yards to accommodate

parking spots, at the expense of green sites, which is very detrimental due to the necessity of organizing additional systems of rainwater removal and diminishing biologically-active areas. On the other hand, high intensity of housing structures is beneficial to urban space, as it enables rational land use, centralization of installations and supply systems and posing opportunities for implementing new, but expensive technologies utilizing renewable sources of energy (photo-voltaic cells of roofs and facades, wind turbines, etc.). In some buildings at Grünau estate, in order to reduce maintenance costs, modern rainwater recovery technologies were implemented, as well as solar panels for heating up tap water.

The houses at the discussed estates were constructed in prefabricated, ferroconcrete technologies. The design of Tysiąclecie was focused on reinforced resistance of structures to mining damages: boxed cellars, framed ferroconcrete shells, rigid ferroconcrete walls. The other examined estate consist of multi-blocks slab technology houses, the entire elements of which: facades, stairs, bathroom cabins (Grünau) were manufactured in factories and delivered to construction sites.

Surely, none of the estates meets the requirements of modern sustainable buildings – the structural components are not made from renewable raw materials and may hardly be reused<sup>1</sup>. The demolition of such buildings is expensive and complex from the logistics point of view, furthermore, reprocessing of ferroconcrete waste requires additional energy outlays. Yet, despite obvious contraindications, about 80 buildings have already been demolished at Leipzig-Grünau due to vacancy and absence of any economic justification for maintaining abandoned buildings.

Likewise, the finishing materials applied in the investigated buildings pose a big problem in terms of ecology – the majority of them are plastics of all sorts, used mainly for lining of the walls, fitted floors, banister handles, partition walls, interior doors, etc. Another problem specific to Polish housing estates are asbestos and cement external siding (Paderewski), which were generally used as walls insulation material in the 1990s and which must be removed and neutralized to the deadline of 2015. However, the disassembly process poses health hazards and environmental hazards. Another problematic type of waste that must be addressed in the refurbishment of large housing estates is asphalt tar used in huge amounts for roof covering – in most buildings it has been replaced in the course of the thermal insulation of the roof floors. Another ecologically disadvantageous phenomena occurring at large housing estates is massive generation of communal waste from households and the necessity of their frequent removal. It is really important to design a proper place for waste storage and sorting, as stipulated in the new laws coming into force this year.

Large housing estates are not a threat to the urban ecosystems. Their composition and balance between the built environment and biologically active environment, plus the opportunity for alternative use of plain roofs and facades surfaces for the implementation of modern environmentally-friendly technologies, are a chance for the improvement of the existing conditions. The compactness of the structural layout may facilitate the optimal use of the sites and their technical infrastructure.

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<sup>1</sup> There are examples of the reuse of dismantled elements of multi-family houses at slab estates- in Sweden the plates were utilized in the construction of detached houses in the same area.

## **4 Economic sustainability**

The construction of large housing estates in both Germany and Poland was financed by local community funds or cooperative funds, and graciously supported by state subsidies and government programs that facilitated loans allowances. After the political and economic transformations and the advance of the free market economy, further funding of the loans taken to build large housing estates became problematic. One of the solutions was the privatization of flats. However, German occupants, unlike their Polish counterparts, were not willing to buy out the flats, and some of the buildings were sold to private investors, or became the property of local communities or housing cooperatives. At the moment, there are eight housing cooperatives operating at Grünau estate, seven private enterprises, and a communal institution (LVB) managing the local community resources. The flats are leased and the rent depends on the location of the flat at a given floor, its technical condition, size and furnishing of the building.

Privatization is an aspect typical of the Polish transformations, as its outcome was the dispersal of ownership – flats were purchased by their previous occupants. Such situation does not facilitate administrative activity and proper management of renovation works; moreover, it creates problems in obtaining investment funds, hinders decision making and debt collection from particular co-owners of buildings.

Tall blocks of flats constructed in the Communist times abound in deficiencies, technical faults and poor workmanship due to low quality of construction materials and hurried construction works; accordingly, from the start of their operation repairs were required. Maintenance costs were very high because of unsealed windows and exterior doors, thin, badly insulated exterior walls and roof floors, heat losses on staircases and on structural elements, high energy-intensity of lifts and lighting of communication routes, etc. Many repair and technical refurbishment works have been conducted for the last few years both at Polish and German housing estates, to adjust them to currently binding stricter provisions concerning thermal intensity of walls and roof floors. Energy efficiency has improved, due to the replacement of lifts, doors, windows, installations, changes of lighting systems in staircases and corridors. The replacement of lifts and bulbs along communication routes and commonly used facilities at Paderewski estate has resulted in the reduction of energy intake by over 50 % [4].

All such activities require substantial financial outlays and the costs are incurred directly by their owners. According to the results of analyses, large buildings housing cooperatives and big owners' associations manage much more effectively than private owners, because it is easier for them to obtain loans and allowances. Private owners cannot often afford to pay high fees allotted for repairs, of which they were not fully aware upon purchase of their flats. In the course of one of the surveys conducted at one of the estates, occupants were asked the following question: "How much did the repair works performed in the building contribute to higher rates charged for basic rent and maintenance fees. In total, 45 % of the respondents at Katowice housing estates stated that the rates (repairs fund, maintenance and energy supply) were considerably higher, especially at Paderewski and Zgrzebnik estates. As many as 26.6 % of the respondents admitted that the fees (rent and energy and water supply) were too high and were a big burden to their household budget, whereas 3.3 % declared that they had obtained subsidies for maintenance costs and 6.0 % had already initiated procedures to obtain such form of financing [4, 5].

The advantages of the investigated estates, as far as economic sustainability is concerned, include: compact shell of buildings, minimization of spatial solutions,

optimization of functional layout of flat and commonly used space, simplicity of materials and technological solutions, intensity of settlements and the resulting reduction of the length of terminals and connections to supply systems and installations. Flats available at Polish and German housing estates vary in size, so the occupants can make optimal choices. The minimal floor area is 35 m<sup>2</sup>, the maximal: 85 m<sup>2</sup>. The flats do not always comply with European spatial standards (kitchens and bathrooms tend to be too small); nevertheless, they offer a decent standard of living and are fully equipped with technical infrastructure. The results of surveys indicate that the occupants are satisfied with their flats. Especially at “Tysiąclecie” the satisfaction level is very high. Referring to the scale of 1 (very satisfied) to 7 (really unsatisfied), generally 80.4 % of the respondents in Katowice marked „1” or „2” (at Tysiąclecie: 55.5 % marked “1” and 28.3 % marked “2”). As far as Grünau in Leipzig is concerned, 27 % of the respondents marked “1” and 43 % marked “2” [4, 5].

Grünau housing estate is facing vacancy problems caused by demographics [6]. A big number of vacant flats in the building generates serious difficulties in maintaining the economic balance, therefore, some of the tall houses were demolished, whereas others reconstructed by making them lower and adjusting the flats to the tenants’ needs – for example, apartments with vast terraces on the roofs were arranged on top floors.

In several buildings rainwater recovery technologies and cellar panels for water heating were implemented to reduce maintenance costs. To improve the economic balance, housing cooperatives at Grünau use various marketing strategies:

- Adjust flats for the needs of seniors and the disabled by widening doorframes, leveling doorsteps, equipping bathrooms and kitchens with special utensils, mounting movable platforms at the entrance doors of buildings, etc;
- Offer flats for short-term rent apartments of various size, depending on the needs, for visitors at Grünau.

The economic factor is strategic in managing large housing estates, as they are very sensitive to global changes in the economy, demography, climate. Because of big housing resources at their disposal, the estates are characterized by a specific inertia and slow response to changes. According to the results of research, demographic changes in Leipzig and the ensuing surplus supply of flats enforced expensive and ecologically harmful activities aimed at elimination of the housing tissue which had not been used up.

On the other hand, as already mentioned above, due to the compact nature of the housing settlements, short routes of energy and water supply systems, centralized heat supply systems, accessibility to urban services and workplaces, the estates are a rational solution to the housing needs in view of economics.

## **5 Social sustainability**

In the past, the constructed housing estates provided new technical quality and functionality, addressing, at the same time a vision of uniform, egalitarian “socialist town” [3] – multi-family structures offering decent housing conditions to a social unit (family), equipped with additional functions: shops, schools, social clubs, facilitating everyday life, all in accordance with the concept of the “neighbourhood unit”, as formulated in 1923 by Clarence Arthur Perry.

In the Communist countries, flats at newly built housing estates were desirable, as they offered good living standard – separable rooms and accessory facilities, central

heating, warm water, lifts reaching higher floors. In a very short time they filled up with occupants representing all walks of life of all social strata, as flat prices, rents and purchase conditions were commanded and centrally controlled, in consistence with the targeted political objectives: social egalitarianism. Enforced social equality, often criticized after the political and economic transformations, had, nevertheless, positive influence of the urban structure: the flats have been occupied by people of different incomes and various level of education, preventing the emergence of poverty ghettos or wealth zones (to date).

The demographic and economic transformations have evoked changes in the social structure of Post-Communist housing estates. In Poland and in Germany a significant rise of 55+ citizens has been noted. In the 1970s and 1980s the social structure of the estates was dominated by young families, whereas these days single households mostly consist of 1 or 2 persons, of which many belong to the so called category of “abandoned nest”: 61 % of the occupants at Tysiąclecie and even 78 % at Grünau [4, 5, 6]. The estates in Katowice (Tysiąclecie and Paderewski), due to their convenient location and close distance to the city centre, affordable prices of flats and good services infrastructure, are still attractive to young singles or families with a small child. The estates are subject to natural change of generations, although, in view of the ageing of our contemporary society, the percentage of retired occupants is significant. Paderewski estate is also inhabited by students because of its vicinity to two universities.

A serious threat to the investigated large housing estates is their bad image propagated by the mass media and functioning in international literature. The estates are stigmatized as hideous relicts of Communism, but the results of surveys among their occupants, as analyzed by experts, reveal a different view- they respondents feel strong bonds with their place of occupancy and value good social, services and transport infrastructures. In the investigated Polish and German estates the majority of the respondent have lived there for over twenty years (at Tysiąclecie more than 40 %). Moreover, there is a significant percentage of those who swap flats within a given estate. At Grünau, 44 % of the households moved at least once within the boundaries of the estate, at Tysiąclecie the percentage reached even 59 % [4, 5].

Another threat for the examined estates is the moving out of affluent people and, on the other hand, moving in of those with lower financial status. This disadvantageous mechanism has been observed at Grünau – where, to attract new clients the owners of buildings offer lowered rents for higher-floor flats, drawing in the unemployed. Such neighbourhood and the ensuing social phenomena generate dissatisfaction of higher-income occupants, who move out to other buildings, which, in turn, creates local ghettos. In Katowice, due to permanent shortage of flats and their market demand, such phenomena have not taken place yet. The social structure of the estates is still varied. The majority of households are run by low and medium income occupants, but more affluent households are still common.

One of the most important opportunities for the investigated estates is their location- the vicinity of green areas, good transport connections with the city centre, good urban space management and availability of recreation sites for children and adults. Another benefit is the social infrastructure: occupants’ clubs, special interest clubs, libraries, reading rooms, training centers, meeting points, etc. The offer is targeted at teenage occupants as well as at seniors. Housing cooperatives are responsible for the organization and maintenance of commonly used space. Upon the occupants’ request new investments are made, enriching the attractiveness of the offer: for example, at Grünau a theatre and skating hall in the previous heat distribution station have been built for the youth, at

Tysiąclecie three modern playgrounds for children (one of which cares for the disabled children), sports fields complex and open-air fitness training field for adults.

## **6 The directions of further sustainable development**

To ensure further reasonable development of the large housing estates erected at the Socialist era and make them complement to modern requirements of sustainable development most important issues of urban-architectural and social may be indicated.

### **6.1 The layout of the urban system:**

- Polish large housing estates: necessity of building multi-level parking lots and reorganizing the existing parking system to go back to the original concept of the separation of pedestrian and car traffic; the reduction of green and recreation zones to provide new parking spots seems to be definitely improper solution;
- Reorganization of the entrance zones of buildings to enhance space identity, promoting rest and leisure sites, adjusting to the needs of seniors, the disabled and small children;
- When the demolition of the existing housing tissue is necessary, the planned disassembly works should entail the most peripheral sites that may be adjusted to serve new urban functions; the demolition policy at Grünau has left vast, empty sites between buildings, which only enhance the sense of isolation and spreading out of wild greenery, contributing to lowered sense of safety.

### **6.2 Directions for buildings and flats:**

- Improvement of the technical quality of buildings and their adjustment to modern requirements concerning thermal efficiency of walls, roof floors, glazed surfaces, entrances, etc;
- Implementation of modern energy-efficiency systems (solar panels, photo galvanic cells, wind turbines, rainwater tanks on roofs and facades of buildings) to reduce maintenance costs;
- Improvement of the attractiveness of flats for hire, to attract new occupants and prevent vacancies – new marketing strategies implementation;
- Adjustment of the flats and commonly used spaces in housing to changing needs of their occupants: smaller households, ageing of the society etc., according to the Built for All and Universal Design ideas.

### **6.3 Social issues:**

- Maintaining the social infrastructure at the estates and enriching it by new solutions, in response of the occupants' needs;
- Introducing the social participation factor in administrative procedures;
- Improving the image of multi-family large housing estates in public opinion.

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