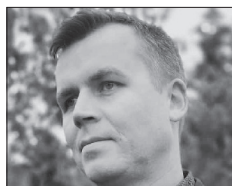


Towards eco-housing estate? – study of actions focused on environmental protection and improvement of living conditions in Wrocław's large housing estates



PhD. Eng.
PAWEŁ ARKADIUSZ PACH
Wrocław University of Science and Technology
Faculty of Architecture
ORCID: 0000-0001-9733-1516



MSc. Eng.
ADRIAN PORADA
Wrocław University of Science and Technology
Faculty of Architecture
ORCID: 0000-0002-4841-5411

The aim of this article is to determine whether the modernization activities and investments carried out so far in Wrocław's large housing estates are heading towards an ecological estate and whether they meet the requirements of sustainable development.

The design of modern residential complexes is increasingly based on the principles of sustainable development. Energy efficiency, minimization of CO₂ emissions, protection of the ecosystem and the health of inhabitants are key aspects of eco-development. Successive implementations of pro-ecological solutions, often through pilot projects, are starting to become the standard for modern, sustainable design. There have also been attempts at comprehensive adaptations of existing buildings in post-war large housing estates to meet contemporary norms and standards. These estates are a distinct and characteristic feature of the urban landscape in many European cities, especially the post-socialist ones, where they constitute approximately 30-50% of the housing stock [1]. After the war they were a response to the worsening housing crisis and dynamic urbanization. Although the technology of construction was practically the same (most often prefabrication), housing estates in Europe were built in different social and economic circumstances and were based on different housing policies which often affected how they were managed, also in terms of renovation decisions [2]. The issue of modernization of large housing estates is crucial for the improvement of quality of the residential environment of current and future residents. The future of such estates will be determined by dynamic global trends. Housing estates already face issues such as climate change, increased environmental awareness, an aging population, and lifestyle changes [3]. To make these estates sustainable, any interventions carried out in them should aim to create a synergy of economic, ecological and social aspects that are consistent with the sustainability triad.

Actions related to technical modernization of residential buildings

One of the most important aspects of adapting large housing estates to modern environmental challenges is the need to bring the existing buildings up to energy efficiency standards [4]. Post-war housing estates, especially those built in prefabricated technology, are subject to the so-called construction cycle and often exhibit a high degree of technical wear and a lower utility value which is incomparable with today's requirements, in particular with respect to ecology [5, 6]. Energy efficiency standards are far more restrictive today than when these es-

tates were erected. This forces managing institutions to make costly investments in an effective energy transition that uses increasingly modern renovation solutions and technologies. In order to illustrate the extent of completed modernizations, similar activities carried out in Wrocław housing estates have been reviewed. Analyses indicate that thermal modernization has been carried out at approximately 90% of Wrocław's large housing estates. A significant number of these modernizations were carried out in the 90s using technologies that are today deemed inefficient. In the case of five housing estates, a secondary thermal modernization was required in order to increase the energy efficiency of the buildings, which would eventually translate into reduced CO₂ emissions. The unsatisfactory results of previous modernizations were also mentioned in a 2019 nationwide NIK Report following the inspection of modernizations carried out in 16 cooperatives in different cities. The report indicated that in terms of energy reduction, the inspected modernizations generally produced 42% lower results than those calculated based on energy audits. In buildings that had been modernized, the consumption of thermal energy decreased by 22% but the cost of energy decreased only by 12% [7]. A solution that could help to achieve better results in terms of heat balance in prefabricated buildings is the so-called deep thermal modernization. In Wrocław, this type of advanced renovations were carried out in full in 52 buildings of the Popowice housing estate and in 2 buildings of the Kozanów housing estate (the cooperative keeps starting new renovation projects – photo 1. and photo 2.). Apart from regular thermal insulation, these projects included insulation of roofs and basement ceilings, replacement of windows in common areas, sanitary modernizations of water pipes and heating systems, repair of ventilation system or implementation of smart solutions. In order to minimize energy consumption, such modernizations often include systems for producing renewable energy [8].

The installation of photovoltaic systems and investments in efficient utility management – such as systems that monitor heat consumption – are another group of solutions that improve energy efficiency. So far such measures have been implemented in Wrocław housing estates by Wrocław - Południe housing cooperative. In 2016-2017, a total of 2,700 photovoltaic panels with a total power of about 740 kWp were installed on buildings in the Południe, Gaj and Huby housing estates. This pow-



Photo 1., Photo 2. Buildings in the Popowice and Kozanów housing estates in Wrocław, which have undergone a secondary, deep thermal modernization

er is roughly equivalent to the annual energy consumption of one 10-storey building. After the panels were installed, the energy consumption in common areas of the buildings dropped by 75% (the photovoltaic panels generated 10% more electricity than initially planned) and CO₂ emissions decreased by approximately 600 tons. To date, the investment of the Wrocław-Południe housing cooperative is the largest project of this type to be carried out in large housing estates and is also the largest distributed photovoltaic power plant in Poland. Additionally, the installation of panels started the cooperation with Wrocław University of Economics aimed at improving environmental protection. The synergy of the know-how and the teaching potential of both entities can help to increase the efficiency of the energy transformation in future projects and serve a success story for other estates. Modernization activities related to the use of renewable energy sources are also carried out in large housing estates in other Polish cities. The Przylesie Housing Cooperative in Sopot has made investments similar to those that were carried out in Wrocław housing estates. In addition to thermal modernizations of buildings, photovoltaic panels have been installed on roofs and new balconies have been built where such panels can be installed in the future [9]. The cooperative estimates that these renovations will save over 7.5 thousand GJ/year, and the consumption of thermal energy will decrease by about 40%. Similar results were obtained in the Radogoszcz-Zachód housing estate in Łódź where a slightly different solution was implemented which is also based on the use of solar energy. Solar collectors were installed on 68 buildings in the estate, which reduced the costs of heat by about 40-50%. Smart solutions also generate significant savings. After installing smart solutions on heat distribution systems the Chomiczówka and Grenadierów cooperatives in Warsaw managed to reduce heat consumption by 13-15% [10].

Another example of an innovative solution, this time designed to reduce the heating of buildings during the summer, are the so-called "cold roofs". In the Gaj housing estate in Wrocław, two multi-family buildings have been modernized using this technology. Measurements taken in these houses show that the temperature of their roofs is 20 degrees lower compared to classical roofing felt. The use of such technologies contributes to the reduction of the urban heat island effect and reduces the rise in temperature on hot days, both in the buildings and indirectly in the entire estate. This also increases the comfort of residents [11].

Energy-efficient transformations of prefabricated buildings have been carried out for years in many European housing estates. An example of international projects of this kind is the complete modernization of the Marksches Viertel in Berlin. This investment made by the GESOBAU cooperative and subsidized by the government helped to reduce CO₂ emissions by 75%, by converting the municipal CHP plant to biomass, among others. The heating costs decreased almost by half while the cost of rent remained almost unchanged [12]. Similar results were ob-

tained under the ECOSTILER demo program, which was implemented under the CONCERTO initiative and co-funded by the European Union. As a result of the implemented actions, there was a clear reduction in primary energy consumption (by 40% in the case of thermal energy), and in the case of three modernized skyscrapers in London total CO₂ emissions were reduced by over 80% [13].

Actions related to the modernization of the functional and spatial program of housing estates

In order to implement the principles of sustainable development, apart from the necessary modernization of the building, interventions in other areas are required, including the functional and spatial program. By ensuring that basic services are easily accessible it is possible to minimize unnecessary car travel and promote pedestrian traffic. Because of the post-war conditions and as a result of numerous demolitions that produced an ample supply of land suitable for multi-family houses, Wrocław's housing estates are conveniently located. Proximity to the city center also translates into easy access to both basic services, such as grocery stores, kindergartens or elementary schools, as well as high-order services, which are mostly located in the center of Wrocław. In view of the above, housing estates in Wrocław do not require any top-down actions to expand the functional program by adding basic services in order to improve their accessibility. What is more urgent are actions aimed at expanding the recreational program of Wrocław housing estates. This aspect is important in large housing estates because, for many years, the internal space of these estates was either very poorly developed or it lacked any recreation and sports infrastructure. These areas served as empty spaces, without a clear identity and a general spatial hierarchy [14]. The transformation of these areas should help in solving economic and environmental conflicts, whereas investments that improve their quality should aim at adapting them to the contemporary challenges, standards and needs of society [15]. In recent years, many investments have been made in Wrocław housing estates in order to "invigorate" common spaces and give them functional and utility values. These projects resemble pro-social activities, by creating places for social interaction, but also pro-environmental and health-promoting activities by improving or developing greenery and introducing sports and recreation infrastructure. A review of investments carried out in Wrocław's housing estates indicates that the current interventions aim to significantly improve the quality and functioning of common spaces by introducing sports and recreation equipment that promotes healthy behaviors. The modernizations in housing estates usually consisted in creating green squares, equipping common areas with infrastructure for children and, increasingly often, also for adults (e.g. outdoor gyms, pergolas, chess tables, etc.). Although some of these investments are carried out when new buildings are added to the existing housing development of the estate (photo. 3.) it is crucial in the implementation of this in-





Photo 3. The main public and recreation space of the Gądów Mały housing estate was added to the building development

infrastructure is the support of municipal participatory programs, including the Wrocław Civic Budget, the Housing Estate Fund and the Micro-grants Program. The results of analyses indicate that since 2013 a total of 18% of all investments selected in all previous editions of WCB have been or are currently being carried out in Wrocław's housing estates. More than 78% of these projects are related to sports and recreation. Particularly popular were projects that serve multiple functions, e.g. by offering both recreational areas as well as multipurpose sports devices. Examples include the Hubosfera center in the Huby estate, Gądów Mały community integration park, (photo. 4.), or the Polana Popowicka in the Popowice estate).

Actions related to equipping Wrocław housing estates with sports and recreation infrastructure are in line with European trends that seek to improve the quality of life in large housing estates. Many countries in Western and Northern Europe recognized the need for a multi-faceted adaptation of post-war large housing estates earlier and they have carried out projects aimed at the practical implementation of eco-development principles and the promotion of pro-health attitudes. An interesting example is the "Varbergparken" housing estate in Haderslev (Denmark), which has been renovated and equipped with an activity park. Additionally, a new functional and spatial program was implemented with a wide range of easily accessible services, recreation places, workplaces or health care facilities [16].

In addition to the above mentioned activities related to equipping housing estates with health-promoting infrastructure, countries in Western Europe also carry out large-scale projects aimed at improving local climatic conditions. A good example of such projects is the transformation of two municipal buildings with their surroundings in Leeds (Great Britain). Apart from a deep modernization of the buildings, the project included the creation of community gardens with almost 100 plots of land for urban farming, a common terrace for residents, an orchard, and communal gazebos and composters. As a result, a pro-ecological, sustainable and social space was created [17]. Similar projects have already been implemented in Polish housing estates. In the Stogi district in Gdansk (in large housing estates among others) rain gardens and micro percolation trenches were created. Some courtyards were also modernized. The surface was replaced with a permeable one, micro retention basins were created and aquatic plants were planted. Sim-

ilar pro-climate projects have also appeared in Wrocław. Since 2019, the Wrocław - Poludnie housing cooperative has been planting urban meadows in the courtyards of housing estates, which expand the biologically active area, increase biodiversity, retain water and positively influence the microclimate.

Summary and conclusions

The modernization activities carried out so far in the majority of Wrocław large housing estates have improved the energy efficiency of the buildings. Unfortunately, the scale of activities promoting the implementation of principles of sustainable development through investments that contribute to the minimization of energy consumption is insufficient for large housing estates to become eco-estates in the coming years. One of the main conclusions from the analyses, including the comparison between activities implemented in Wrocław housing estates and international projects, is that projects in Wrocław are not comprehensive. The projects implemented by housing cooperatives are fragmentary and selective. As shown in the NIK report, thermal modernizations on their own do not produce the expected energy savings. The international projects mentioned in the article show that comprehensive actions which address the issue of energy efficiency of all building elements produce much better results. Such projects are usually much more expensive and therefore must rely on external funding programs. The shortage of such programs for Polish housing cooperatives and thus the lack of sufficient financial resources are not the only obstacles to comprehensive modernizations in Poland. The international housing estates where pro-environmental programs are implemented function on the basis of quasi-institutional rent, which makes it easier to carry out the renovation process, e.g. by allowing for temporary resettlement of the residents. Given the current ownership structure of Polish housing estates such activities are impossible. Nevertheless, in spite of financial and organizational limitations, more comprehensive modernization projects are being implemented in Wrocław housing estates, which shows that it is possible to achieve the effect of synergy in activities in various fields and that this effect helps to significantly reduce heat consumption and CO₂ emissions.

The conclusions from the analysis activities related to the modernization of the functional and spatial program of Wrocław housing estates



Photo 4. Multifunctional recreational space of the Gądów Mały housing estate

are positive. The trend toward an improvement in the quality of open spaces in housing estates is becoming more and more clear. The large number of sports and recreation facilities for various age groups is improving the quality of the housing environment and, indirectly, the health of the residents, which is particularly important in the context of population ageing. The pro-environmental projects carried out in large housing estates (rain gardens, and urban meadows) help to improve local climate conditions and follow the principles of sustainable development. Perhaps these pioneering projects and new programs that promote modernizations of large housing estates will encourage other housing cooperatives to participate in the process of comprehensive modernizations. As a result, despite technical, organizational and financial difficulties, modernized and energy-efficient housing estates would have a real chance, in the long term, to become ecological housing estates which offer a healthy and comfortable residential environment.

References

- [1] Müller E., Großwohnsiedlungen in europäischen Städten [w:] Beiträge zur Regionalen Geographie, no. 45, Institut für Länderkunde, Leipzig 1997.
- [2] Porada A., Typologie von Großwohnsiedlungen im postkommunistischen Polen, [w:] Big Beautiful Buildings: die Nachkriegsmoderne im europäischen Diskurs, red. Reicher Ch., Tietz J. Ch., Ulku Y., Verlag Kettler, Dortmund 2019. s. 174–180.
- [3] Wassenberg F., Large housing estates: ideas, rise, fall and recovery, The Bijlmermeer and beyond, IOS Press, Amsterdam 2013.
- [4] Tofiluk Anna, 2020, Prefabrykowna architektura mieszkaniowa a zmiany klimatyczne. „Builder” 03 9272) DOI: 10.5604/01.3001.0013.8483.
- [5] Chmielewski J.M., Teoria urbanistyki w projektowaniu i planowaniu miast, Oficyna Wydawnicza Polityki Warszawskiej, Warszawa 2001.
- [6] Szulc J., Techniczne możliwości modernizacji budynków z wielkiej płyty [w:] Izolacje, 2/2010, s. 14–23.
- [7] Raport NIK: Efekty termomodernizacji wielorodzinnych budynków mieszkalnych, będących w zasobach spółdzielni mieszkaniowych, realizowanej z udziałem środków publicznych, NIK, Warszawa 2019.
- [8] Strategia modernizacji budownictwa: mapa drogowa 2050, praca zbiorowa, IeS, BPIE, NAPE, KA-PE, PwC, Kraków 2014.
- [9] www.smprzylesie.pl/index.php/termomodernizacja, dostęp: 27.11.2020.
- [10] www.energiadlawarezawy.pl/zarzadzanie-energia-ciepna-w-budynku/, dostęp 27.11.2020.
- [11] www.wroclaw-poludnie.pl/ekologia, dostęp 26.11.2020.
- [12] www.use.metropolis.org/case-studies/deutschlands-grosste-niedrigenergiesiedlung-das-markische-viertel#casestudydetail, dostęp: 27.11.2020.
- [13] www.smartcities-infosystem.eu, dostęp 26.11.2020.
- [14] Basista A., Betonowe dziedzictwo. Architektura w Polsce czasów komunizmu, Wydawnictwo Naukowe PWN, Warszawa-Kraków 2001.
- [15] Chmielewski J. M., Mirecka M., Modernizacja osiedli mieszkaniowych, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2007.
- [16] www.cfmoller.com, dostęp: 25.11.2020.
- [17] www.urbanplash.co.uk/regeneration/projects/saxton, dostęp: 27.11.2020.

DOI: 10.5604/01.3001.0014.7423

CORRECT QUOTATION FORMAT

Pach Paweł Arkadiusz, Porada Adrian, 2021, Towards eco-housing estate? – study of actions focused on environmental protection and improvement of living conditions in wrocław's large housing estates, „Builder” 3 (284). DOI: 10.5604/01.3001.0014.7423

Abstract: The aim of this article is to determine whether the modernization activities and investments carried out so far in Wrocław's large housing estates are heading towards an ecological estate and whether they meet the requirements of sustainable development. The analyses were based on available literature and the author's inventory of housing estates in Wrocław in terms of technical modernization of buildings and improvement of the functional and spatial program. This paper is a general review and the individual activities are connected to examples from other Polish and European cities, with particular emphasis on energy efficiency, ecology and adaptation of housing estates to contemporary challenges of civilization.

Keywords: large housing estates, quality of the housing environment, eco-housing estates

Streszczenie: W STRONĘ EKOOSIEDLA? – ANALIZA DZIAŁAŃ W ZAKRESIE OCHRONY ŚRODOWISKA I POPRAWY JAKOŚCI ZAMIESZKIWANIA NA TERENACH WROCŁAWSKICH OSIEDLI WIELKOBLOKOWYCH. Artykuł ma na celu określenie, czy dotychczas wdrażane działania modernizacyjne oraz inwestycje realizowane we wrocławskich osiedlach wielkoblokowych zmierzają w kierunku ekologicznego osiedla, a także czy spełniają wymagania zrównoważonego rozwoju. Analizy przeprowadzono w oparciu o dostępną literaturę oraz autorską inwentaryzację osiedli we Wrocławiu w zakresie modernizacji technicznej zabudowy oraz poprawy programu funkcjonalno-przestrzennego. Praca ma charakter przeglądowy, a poszczególne działania odniesiono do przykładów z innych miast Polski i Europy, ze szczególnym naciskiem na kwestie energooszczędności, ekologii oraz adaptacji osiedli do współczesnych wyzwań cywilizacyjnych.

Słowa kluczowe: osiedla wielkoblokowe, jakość środowiska mieszkaniowego, ekoosiedla