Wałbrzych Green City Action Plan

December 2022

Source: City Hall of Wałbrzych

European Bank for Reconstruction and Development

EBRD GREEN CITIES

Taiwan Business EBRD Technical Cooperation Fund

Ministerstwo Finansów

Sotis Advisors

ARUP

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Abbreviations and Definitions

Abbreviations

BMS	Building Management System
CCTV	Closed-circuit television
CO_2	Carbon dioxide
DIP	Dynamic Passenger Information (pol. *Dynamiczna Informacja Pasażerska*)
DK	Country Road (pol. D*roga krajowa*)
EBRD	European Bank for Reconstruction and Development
EMS	Energy Management System
ESCO	Energy Services Company
GCAP	Green City Action Plan
GDB	Gross domestic product
HEMS	Home Energy Management System
HPV	Human papilloma virus
IT	Information Technology
ITS	Intelligent Transportation Systems
KPO	National Reconstruction Plan (pol. *Krajowy Program Odbudowy*)
KW	Kilowatt
KWh	Kilowatt hour
KWp	Kilowatt peak
MW	Megawatt
MWh	Megawatt hour
MZUK	Municipal Utilities Authority in Wałbrzych (pol. *Miejski Zakład Usług Komunalnych w Wałbrzychu*)
NFOŚiGW	National Fund for Environmental Protection and Water Management (pol. *Narodowy Fundusz Ochrony Środowiska i Gospodarki Wodnej*)
NH_4^+	Ammoniacal nitrogen
PEC S.A.	Heating Energy Company Public Limited Company (pol. *Przedsiębiorstwo Energetyki Cieplnej Spółka Akcyjna*)
PKN Orlen S.A.	Polish Oil Concern Public Limited Company (pol. *Polski Koncern Naftowy Orlen Spółka Akcyjna*)
PM_{10}	Particulate matter less than 10 µm in size
$PM_{2,5}$	Particulate matter less than 2,5 µm in size
PSZOK	Selective collection points for municipal waste (pol. *Punkty selektywnej zbiórki odpadów komunalnych*)
PV	Photovoltaics

RES	Renewable energy sources
RIRAP	Rapid Infrastructure Resilience Appraisal & Action Plan
SCADA	Supervisory Control and Data Acquisition
SCATS	Sydney Coordinated Adaptive Traffic System
SZOP	Problem Waste Collection Cars (pol. *Samochody Zbierające Odpady Problemowe*)
UE	European Union
UN	United Nations
UNCBD	United Nations Convention on Biological Diversity
WHT	Wałbrzych Technology Hub
WPWiK sp. z o.o.	Waterworks and Sewage System Company in Wałbrzych Limited liability company (pol. *Wałbrzyskie Przedsiębiorstwo Wodociągów i Kanalizacji Spółka z ograniczoną odpowiedzialnością*)
WSSE	Wałbrzych Special Economic Zone (pol. *Wałbrzyska Specjalna Strefa Ekonomiczna)*
WEEE	Waste electrical and electronic equipment (pol. *Zużyty sprzęt elektryczny i elektroniczny*)

Definitions

Adaptation to climate change	Adaptation to current or expected climatic conditions and their effects.
Active mobility	Individual mobility conducted on foot or by bicycle, but also with the help of other non-motorised means of transport or ways of moving in space (on rollerblades, scooters).
Biodiversity	The diversity of living organisms within ecosystems, within and between species, and the diversity of ecosystems (Nature Conservation Act of 16 April 2004).
Biologically active area	Native soil covered with vegetation and surface water on the building plot, and 50% of the sum of the surfaces of terraces and flat roofs, arranged as permanent lawns or flowerbeds on a substrate ensuring their natural vegetation, with an area of not less than 10 m2.
Blue-green infrastructure	A network of natural and semi-natural solutions that fulfil many functions. Blue-green infrastructure includes many forms of retention: ponds, basins – hollows of the area, reservoirs, rain gardens (performing on the one hand the function of rainwater management, on the other – their purification), green and wetland areas, etc. (Ministry of Infrastructure and Construction, November 2016).
Climate neutrality	The (zero) balance between greenhouse gases emitted and their storage or absorption by water bodies, forests or soils.
Circular economy	A regenerative economic system that minimises the consumption of raw materials and the volume of waste, as well as emissions and energy losses, by creating a closed loop of processes in which waste from one process is used as raw material for another, thus reducing production waste as much as possible.
Cluster	A spatially (geographically) concentrated group of companies from the same or related sectors, as well as institutions and organisations, linked by a network of vertical and horizontal dependencies, competing and cooperating with each other.
Cogeneration	A technological process of simultaneous generation of electricity during which the resultant heat produced from such a process is usefully efficiently utilised.
Decarbonisation	A process that involves the systematic reduction of carbon dioxide (CO_2) emissions into the atmosphere, with the aim of eventually ceasing emissions altogether.
Decontamination	The process of removing and inactivating a harmful substance (chemical, radioactive material, biological agents) that threatens the life or health of living organisms and restoring it to safe health.

Digital transformation	Using technology to transform analogue processes into digital ones.
Dynamic Passenger Information	An integrated information system that provides information and data on the performance of public transport services to passengers and makes it available to supervisory services. The primary task of the DIP system is to provide passengers with information about the estimated departure time of a vehicle operating a specific line from a selected stop.
Energy efficiency	It is the ratio between the achieved performance of a facility, appliance or installation, under typical conditions of use or operation, and the amount of energy consumption required by that facility, appliance or installation to achieve that performance. Energy efficiency measures consist of changes or improvements to a facility, equipment or installation, resulting in lower operating costs and reduced primary energy consumption.
Environment	All natural elements, including those transformed as a result of human activity, in particular the surface of the earth, minerals, water, air, landscape, climate and other elements of biodiversity, as well as the interaction between these elements (Act of 27 April 2001 Environmental Protection Law).
ESCO formula	Energy Saving Company. An investment implementation formula aimed at introducing permanent energy savings in a company through measures taken in cooperation with a contractor specialising in energy services.
Green areas	Areas with technical infrastructure and buildings functionally related to them, covered with vegetation, performing public functions, in particular parks, greens, promenades, boulevards, botanical gardens, zoological gardens, historic gardens, cemeteries, greenery accompanying roads in the development area, squares, historic fortifications, buildings, storage yards, airports, railway stations and industrial facilities (Law of 16 April 2004 on nature protection).
Green/clean electricity	Electricity that is generated from renewable energy sources or nuclear energy.
Inclusivity	An approach based on equality, acceptance of diversity, leading to social inclusion, ensuring equal opportunities for people from diverse backgrounds. The main objectives of inclusivity and diversity involve: ensuring gender equality, eliminating all prejudice and discrimination, considering the needs of people with disabilities (Council of the European Union).
Innovative technologies	Implementation of a new or significantly improved technology in business practice, workplace organisation or relations with the environment.

Land reclamation	Granting or restoring degraded or devastated land to utility or natural values through proper terrain, improvement of physical and chemical properties, regulation of water relations, restoration of soils, strengthening of slopes and reconstruction or construction of necessary roads (Act of 3 February 1995 on the protection of agricultural and forest land).
Landscape	A space perceived by people, containing natural elements or products of civilisation, shaped because of natural factors or human activity (Spatial Planning and Development Act of 27 March 2003).
Low emissions	Emissions of dust and harmful gases at heights of up to 40 m. These pollutants come from domestic heating cookers and local coal fired generation units, where coal is burned inefficiently, and from combustion transport.
Low-emission transport	Vehicle powered by alternative fuels, allowing to reduce the emission of transport, which include, among others: hybrid buses, buses powered by: liquid biofuels, synthetic fuels, paraffin fuels, compressed natural gas (CNG), liquefied natural gas (LNG), gas from biomethane, liquefied petroleum gas (LPG).
Modernisation	Upgrading, modernisation of a product, permanent improvement, e.g., of an existing building leading to an increase in its use value.
Natura 2000	Special protection area for birds, a specific area of conservation of habitats or an area of Community importance established for the purpose of protecting populations of wild birds or natural habitats or species of Community interest (Law of 16 April 2004 on nature conservation).
Pocket Park	Publicly accessible park of small size.
Public transport	Publicly available regular passenger transport performed at specified intervals and along a specified transport line, transport lines or transport network (Act of 16 December 2010 on public collective transport).
Public-private partnership	Joint implementation of a project based on the sharing of tasks and risks between the public entity and the private partner (Act of 19 December 2008 on public-private partnership).
Reference range	Benchmarks, defined by the European Bank for Reconstruction and Development, developed from published international norms and standards set by global organisations such as the World Organisation (WHO), the European Environment Agency (EEA), the Organisation for Economic Co-operation and Development (OECD), and Local Governments for Sustainability (ICLEI).

Refugee	A person who has had to leave the area in which he or she was living due to several types of persecution. The resulting threat to life, health or liberty is most often related to armed struggles or oppressive actions because of religion, origin or political beliefs.
Remediation	Subjecting soil, land and groundwater to measures which remove and reduce the number of risk-causing substances; controls them and limits their spread so that the contaminated site ceases to pose a risk to human health or the state of the environment; and considers the current and, where possible, future use of the site. Remediation may consist in self-cleaning if it brings the greatest benefits to the environment (Act of 27 April 2001, Environmental Protection Law).
Retention basin	A reservoir is an artificial body of water whose purpose is to store water in times of excess and to allow use in times of shortage.
Revitalisation	The process of taking degraded areas of the city out of crisis and adding new functions to them (through holistic measures, i.e., interrelated undertakings covering social and economic, spatial-functional, technical or environmental issues).
Selective waste collection	It consists of collecting municipal waste in separate containers directly at the place of generation. In the context of separate collection, a given waste stream comprises only waste with the same properties and the same characteristics, i.e., plastic, glass, paper, bio.
Smart City	Creative, sustainable city in which the quality of life is improved, the environment becomes friendlier and the prospects for economic development are stronger. Its distinguishing feature is "smartness", which can be understood as the sum of various improvements regarding the functioning of urban infrastructure and city resources, as well as public services (Lee, Gong Hancock and Hu, 2014).
Smart Meter	A meter to optimise electricity consumption for own consumption purposes.
Spatial order	The way in which a space is arranged to form a harmonious whole. Spatial order considers in orderly relations the following conditions and requirements: functional, socio-economic, environmental, cultural, compositional and aesthetic.
Special Economic Zone	Special Economic Zones are administratively separate areas in Poland where business activities are conducted under special, preferential conditions, e.g., tax breaks, in order to attract investors.
Sustainable development	Socio-economic development, in which a process of integrating political, economic and social activities takes place, with preservation of natural balance and sustainability of basic natural processes, in order to guarantee the possibility of satisfying the basic needs of particular

	communities or citizens both present generation and of future generations (Act of 27 April 2001 Environmental Protection Law).
Sustainable Development Goals – SDGs	An action plan for the transformation and reshaping of the world in which the needs of the present generation can be met in a sustainable manner, respecting the environment and respecting the needs of future generations.
Thermomodernisation	A set of measures aimed at reducing the demand and consumption of energy supplied for heating and hot water in a facility and the costs incurred for it.
Urban heat island	A meteorological phenomenon involving the thermal preference of urban spaces over surrounding undeveloped areas.
Waste management	Collection, transport, recovery and disposal of waste, including supervision of operations and disposal sites.
Wastewater management	Wastewater management and water status and distribution, together with water treatment to reduce water losses and wastewater generation.
Water resources of the city	Surface and groundwater resources found within the city.
Water retention	Storage of rainwater on the ground surface, in the ground and in natural and artificial reservoirs.
Zero-emission transport	Vehicle that uses electricity for propulsion, including energy generated from hydrogen in fuel cells installed in them, or an engine whose duty cycle does not emit greenhouse gases or other substances covered by the emission management system for greenhouse gases and other substances (Act of 11 January 2018 on electromobility and alternative fuels).

Definitions – Actions descriptions

Action benefits	Benefits related to improving the quality of environment and life in the city and strengthening the city's climate resilience.
Action owner	The unit responsible for the preparation, implementation and monitoring of actions under the Green City and Climate Action Plan of Warsaw.
Capital expenditure (CAPEX)	Expenditure related to the cost of constructing the facility, purchasing equipment, making the investment.
Financing mechanisms	The way in which a company, organisation or programme receives the funding it needs to continue operating.
Main stakeholders	Organisations or individuals with a direct interest in consulting on the implementation of the action and the results of its application.
Operating expenditure (OPEX)	Expenses associated with maintaining a product, business or system.
Performance indicators	Measurable impact resulting from the implementation of the action.
Potential for inclusiveness of action and improvement of social conditions	Opportunities to apply solutions to increase inclusivity, social diversity and accessibility in the implementation of the action.
Pre-investment costs	Expenditure relating to pre-investment work, e.g., the preparation of an investment feasibility study, a study of the development of a legal framework, a technical or locational analysis, a plan or directions for development, a multi-variant concept.
Risk mapping	Risks or challenge from which the action needs to be conducted in order to minimise them.

Smart potential	Opportunities to introduce digital technologies, oriented towards smart, innovative solutions in the implementation of the action.
Timeline	Range of years in which the action will be implemented.
Type of action	Specification of the type/scope of action, broken down into capital investment and enabling actions.

Foreword from the Mayor

"Wałbrzych is not a big city, but it is very ambitious."

As the Mayor of a city with a population of 100,000, which, like its inhabitants, has struggled for many years with adversity, I can say that we are all proud of implementing the Green City Action Plan in Wałbrzych. This is a great honor for us and at the same time we are aware that we have a long way to go.

I must emphasize that over five centuries of coal mining in Wałbrzych and its vicinity have left their mark: on nature, forests, urban land use, and, above all, the lives of our citizens. Despite the mining industry being inactive for almost three decades, the traces it left behind are still visible and felt by residents and tourists alike – as evidence by the hoisting towers still towering over the city or visits to the Old Mine, where we collect and cultivate the history of mining, geology, porcelain and many cultures that are present in Wałbrzych.

We are perfectly aware that we need to make further efforts, and probably also a few sacrifices, to make our place on Earth, which is Wałbrzych, better for us, our children and future generations. The actions we take under the GCAP will improve the living environment, its quality and reduce our current negative impact on nature. The residents of Wałbrzych have a certain feature that will help us in achieving everything that we assume in the Green City Action Plan: it is perseverance and striving to achieve the set objectives. Such fortitude allowed us to survive the most difficult moments after the closure of the mines, when over twenty thousand people lost their livelihood overnight, unemployment reached almost 30%, and consequently nearly thirty thousand inhabitants left the city.

I am convinced that we will implement the actions described in this document, it is our ambition and aspiration supported by experience that is not available in other cities.

Not so long ago, there were days when it was impossible to breathe freely when leaving the house to go to the street, when Pełcznica and Szczawnik were polluted rivers, and the soil was poisoned with waste from mines and coking plants. We remember it well and that is why we know that our future is sustainable development, healthy inhabitants, clean natural environment. We are aware that the world is changing and we need to keep up with it by developing friendly and ecological transport, improving waste management, reducing water and heat consumption, but also facilitating education and ensuring that residents simply live better. Our goal and the ambition are to make Wałbrzych an even greener city, to fully deserve the name Green City.

Roman Szełemej

Mayor of the city of Wałbrzych

Executive summary

Source: City Hall of Wałbrzych

Executive summary

Introduction

Wałbrzych Green City Action Plan (GCAP) aims to support the sustainable development of a city focused on improving the quality of the environment, increasing resilience to climate change, improving the living conditions of residents, and supporting diversity and social inclusivity. The European Bank for Reconstruction and Development (EBRD Green Cities) programme supports the city in identifying and prioritising and investing resources to improve the city's environmental performance.

Methodology

Green City Action Plan Methodology was used. The preparation of the document consisted of four stages, including:

- Analysis of the city's condition and priorities.
- Developing a vision, objectives and actions.
- Defining the steps and schedule for implementing the assumptions.
- Development of monitoring rules.

The Green City Action Plan was based on data obtained during many meetings, consultations, workshops with city representatives and external stakeholders, in order to consider, the current and future needs of various social groups - city residents, non-governmental organizations, scientific circles, social organizations as well as city companies and entities.

In the process of preparing the Green City Action Plan, the priorities and assumptions of documents binding at the international, national and local level were also considered.

The implemented actions and plans already developed by the city were also considered, e.g., submitted under the Just Transition Fund for the Wałbrzych Subregion.

Inclusive and stakeholder engagement

Engagement has been a fundamental part of the GCAP process. A wide range of stakeholders were involved in the key stages of the process:

- Meetings and workshops related to the identification of key challenges and priorities faced by the city.
- Conversations and surveys on the vision, objectives and directions for the development of the Green City Action Plan.
- Work on defining the actions included in the Green City Action Plan.

In total, over 25 associations and non-governmental organizations, foundations, representatives of education, city companies, state and regional institutions participated in the process. Over 250 participants took part in workshops and meetings in the city, and over 630 resident views were collected in surveys.

Assumptions of the Green City Action Plan

Crucial to the development of the vision, goals and direction of the Green City Action Plan was to identify and prioritise the challenges faced by the city. As a result of the analysis and workshop work, the identified priority environmental challenges of Wałbrzych include:

- Air quality
- Surface water pollution and access to water
- Mitigation of climate change
- Water, greenery, biodiversity, and ecosystems
- Soil quality
- Adaptation and resilience to disaster risks

Priority challenges

In order to support the city's development, sectors have been identified where measures should be implemented to help meet the challenges identified:

Sector	Challenges
Energy	» Modernisation of energy sources and development of RES » Improving energy efficiency
Buildings	» Limiting emissions » Improving the conditions of the existing municipal resources
Transport	» Integration of transport in the city
Land Use	» Remediation of brownfield sites
Water and sewage management	» Providing a resource of own and low-cost drinking water » Improvements to the sanitary and stormwater drainage network system » Development of rainwater retention areas
Waste	» Reduction of wild landfill sites
Cross-sectoral	» Further development of industry and new investments in the city while ensuring adequate environmental and municipal management standards

Vision, objectives, actions

A thorough analysis of the current state of the city in the areas of the environment, economy and infrastructure as well as social aspects and the assessment of the maturity of a Smart City, and then the identification of priority challenges allowed for the defined of the vision and objectives of the Green City Action Plan of Wałbrzych. The process involved broad involvement of municipal and external stakeholders, who emphasized the importance of city development focused on the needs of residents, providing a suitable place for work, development and leisure. As the city is an ex-coal mine city, the rates of unemployment after the mines were closed rose from below 6% in the early 1990s to 28% by 2002. Nowadays the situation is much better, but the city still needs investments in a just transition, what has been underlined by the city stakeholders during workshops and meetings. This influenced the vision especially in terms of the quality of life and work in the city and the fossil fuel switch.

The vision of the city assumes:

Wałbrzych will be a zero-emission city, implementing the assumptions of sustainable development, attractive to residents, providing them with appropriate conditions for development, work and leisure, where high natural values are preserved, blue-green infrastructure is implemented and takes care of the cultural heritage, creating ideal conditions for the development of future generations.

In order to support the vision assumptions, 12 objectives of the Green City Action Plan have been developed, including:

- C1 - Striving for decarbonization and achieving climate neutrality.
- C2 - Implementation of strategies aimed at reducing low emissions.
- C3 - Increasing the energy efficiency of infrastructure and buildings.
- C4 - Providing accessible, high-quality services, social and housing infrastructure.
- C5 - Supporting environmentally friendly, safe and integrated transport.
- C6 - Improving the functioning of urban infrastructure through the development of innovative technologies and digital transformation.
- C7 - Improving the spatial order along with the protection of land through constant revitalization and decontamination of degraded areas.
- C8 - Actions to adapt and increase the city's resilience to climate change
- C9 - Development, effective use and protection of the city's water resources.
- C10 - Improving and strengthening the functioning of the city's water and sewage management.
- C11 - Strengthening the ecological awareness of the inhabitants and improving the quality of selective waste collection.
- C12 - Building a strong and aware local community and social activation.

As part of the Green City Action Plan, 26 actions were proposed that fit into the objectives developed, in seven areas covering the following sectors:

- Energy
- Buildings
- Transport
- Water and sewage management
- Land use
- Waste
- Industry
- Cross-sectoral actions.

These actions will be implemented in the perspective of 2030 and include both capital investments and enabling actions.

Table 1 Types of actions developed under the GCAP

Action type	Definition	Actions (abbreviations according to the tables below)
Capital investment	Long-term, complex and multidimensional capital-intensive investment projects	E1, E2, E3, B1, B2, B3, T1, T2, T3, T4, T5, O1, O2, O3, U1, U2, W1, W2, M6, M7
Enabling action	Actions to raise public awareness, increase the city's resilience and support residents and tackle social exclusion	W3, M1, M2, M3, M4, M5

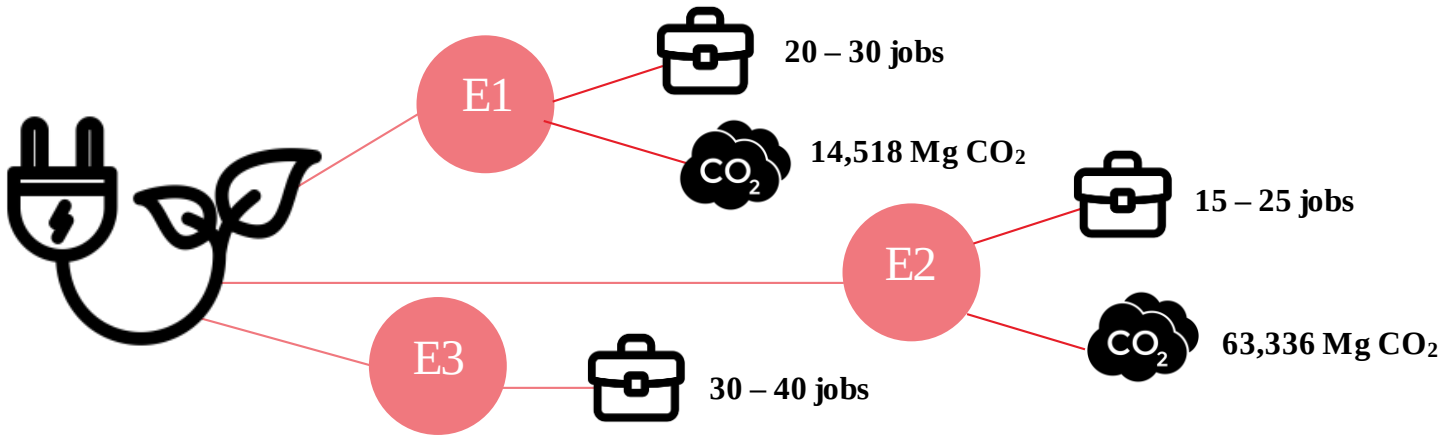
It is estimated that the total capital cost (the sum of pre-investment costs and CAPEX) of the developed actions will amount to over EUR 448 million. The complete implementation of the proposed actions will entail annual costs (OPEX) of EUR 18 million.[1]

The following sections summarize the actions developed under the Green City Action Plan, which will be the inspiration and basis for the city's development and future investments.

[1] In the document, an average annual exchange rate of 1 EUR = 4.67 PLN (valid as of 1st November) was adopted. Insignificant discrepancies in values may result from the adopted roundings. The estimated values were based on a set of more than 400 indicators and relatively similar investments undertaken domestically and internationally.

Actions in the **Energy** sector

ID	Action	Action type	Pre-investment costs (‘000 EUR)	CAPEX (‘000 EUR)	OPEX (‘000 EUR /year)	Action owner	Timeline 2023	2024	2025	2026	2027	2028	2029	2030
E1	Construction of PV farms in the city	Capital investment	4,682	37,272	532	Environment and Climate Department								
E2	Development of local heat sources based on RES. Intensification of the use of green energy	Capital investment	10.7	37,195	14.1	Thermal Energy Company in Wałbrzych								
E3	Modernization of the distribution network	Capital investment	1,938	27,781	1 073.8	Tauron Dystrybucja S.A. – Office in Wałbrzych								

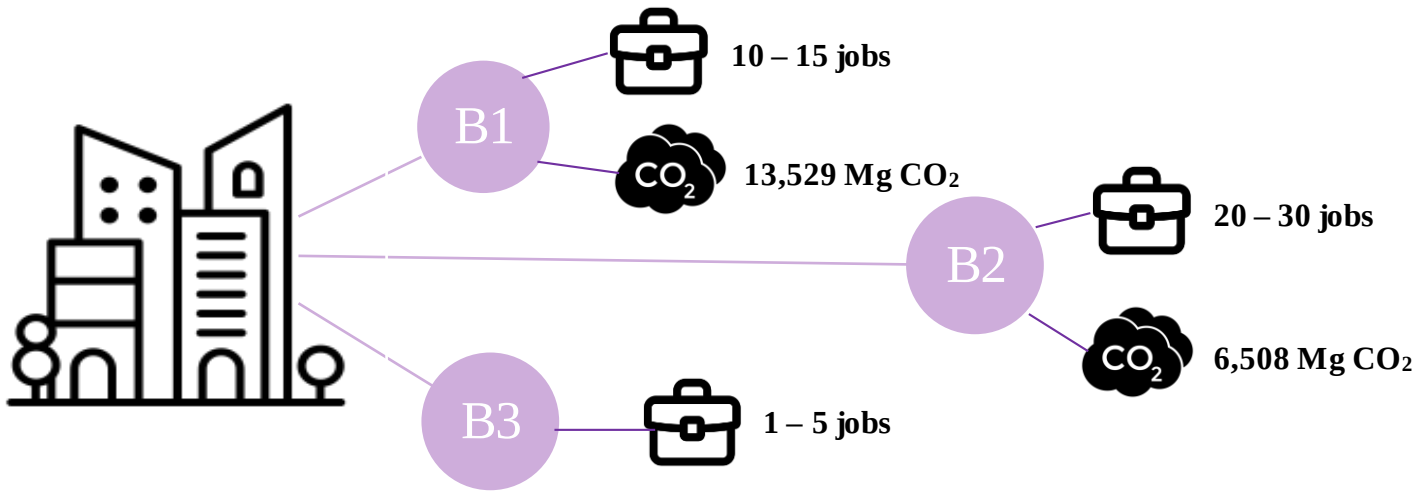


Legend

Energy Sector | New potential jobs | Estimated annual reduction in CO_2 emissions

Actions in the **Buildings** sector

ID	Action	Action type	Pre-investment costs (‘000 EUR)	CAPEX (‘000 EUR)	OPEX (‘000 EUR/year)	Action owner	Timeline 2023	2024	2025	2026	2027	2028	2029	2030
B1	Further modernization of the district heating system	Capital investment	n/a	10,261	n/a	Thermal Energy Company in Wałbrzych								
B2	Creating a program of deep thermal modernization and revitalization of municipal buildings in the city	Capital investment	n/a	54,621	n/a	Municipal Board of Buildings								
B3	Tackling energy poverty	Capital investment	n/a	100,159	n/a	Organizational Department								



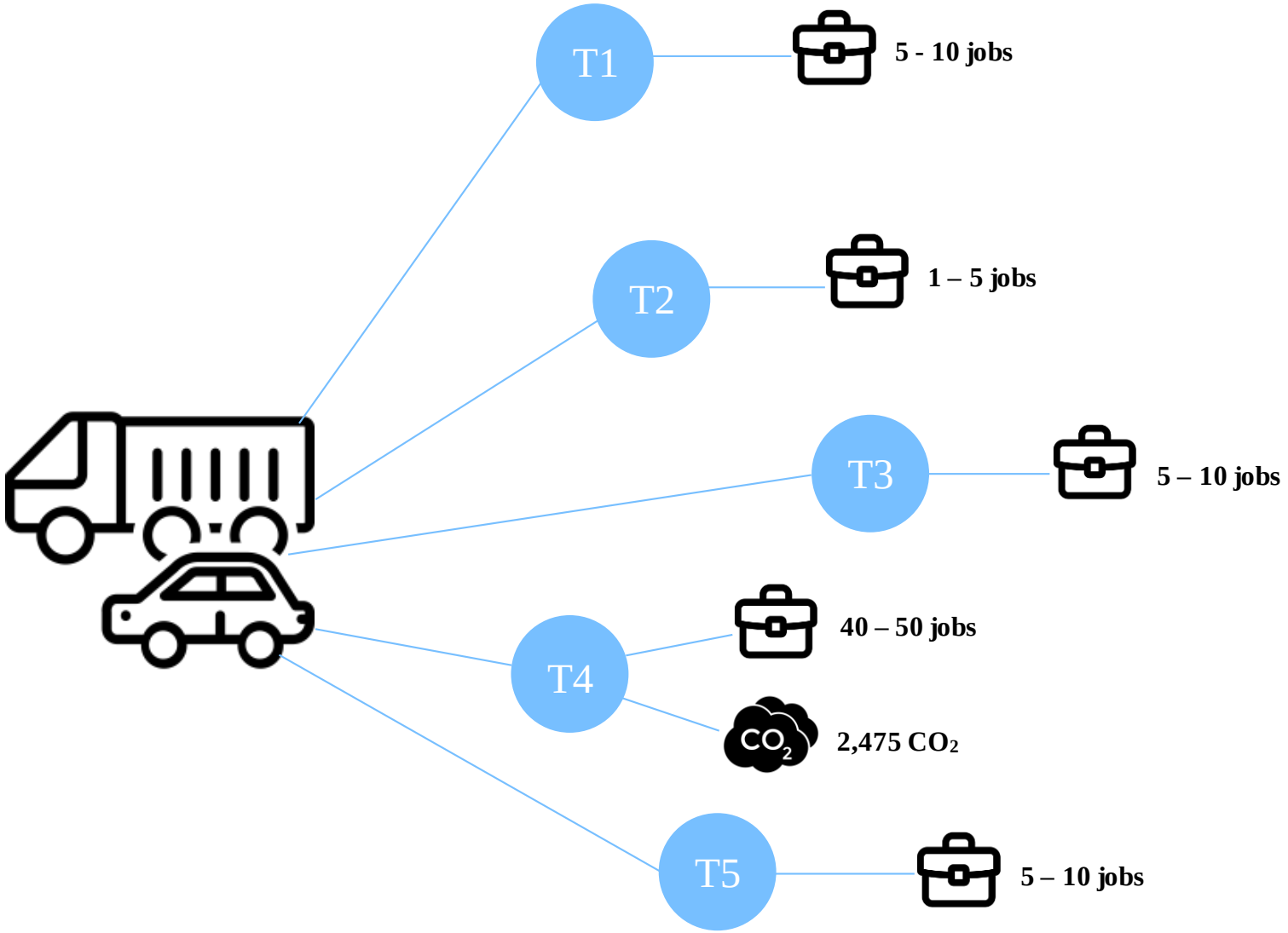
Legend

Buildings sector | New potential jobs | Estimated annual reduction in CO_2 emissions

Actions in the **Transport** sector

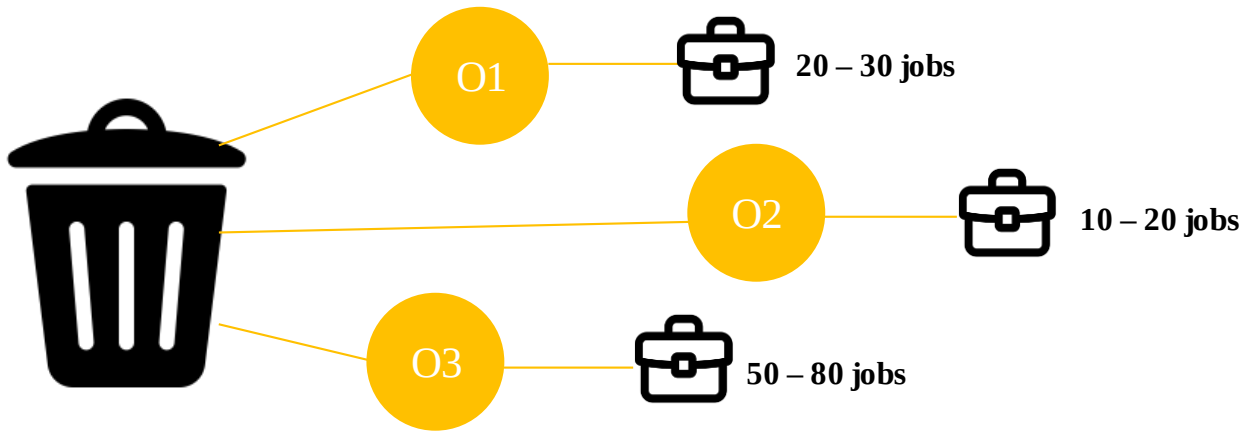
ID	Action	Action type	Pre-investment costs (‘000 EUR)	CAPEX (‘000 EUR)	OPEX (‘000 EUR/year)	Action owner	Timeline
T1	Improving the public transport and the ticketing system	Capital investment	128.8	3,543	112.7	Road, Transport and City Maintenance Authority in Wałbrzych	
T2	Development of bicycle infrastructure in the city	Capital investment	75	5,256	2.5	Road, Transport and City Maintenance Authority in Wałbrzych	
T3	ITS system development	Capital investment	n/a	12,600	n/a	Intelligent Transport System Centre	
T4	Development of the potential for the use of green hydrogen in the city	Capital investment	n/a	18,429	12,002	Road, Transport and City Maintenance Authority in Wałbrzych	
T5	Promotion of zero-emission transport	Capital investment	n/a	836	43	Road, Transport and City Maintenance Authority in Wałbrzych	

Actions in the **Transport** sector



Actions in the **Waste** sector

ID	Action	Action type	Pre-investment costs (‘000 EUR)	CAPEX (‘000 EUR)	OPEX (‘000 EUR/year)	Action owner	Timeline
							2023 2024 2025 2026 2027 2028 2029 2030
O1	Smart municipal waste management system	Capital investment	n/a	34,812	112.2	Environment and Climate Department	
O2	Municipal system of selective waste collection and recycling	Capital investment	n/a	4,806	493.9	Environment and Climate Department	
O3	Circular waste management	Capital investment	n/a	12,885	322.1	Environment and Climate Department	



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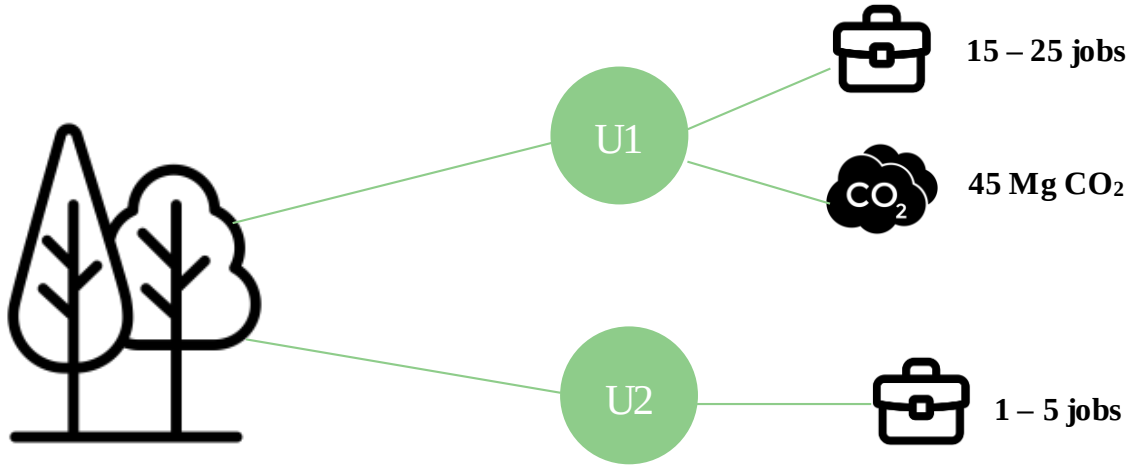
Waste sector

New potential jobs

Actions in the **Land Use** sector

ID	Action	Action type	Pre-investment costs (‘000 EUR)	CAPEX (‘000 EUR)	OPEX (‘000 EUR/year)	Action owner	Timeline							
							2023	2024	2025	2026	2027	2028	2029	2030
U1	Further development of pocket parks in the city and protection and restoration of valuable land in the city	Capital investment	10.7	2,332	18.4	Environment and Climate Department								
U2	Revitalization and decontamination of degraded areas	Capital investment	91.8	29,640	256	Revitalization and Spatial Planning Department								



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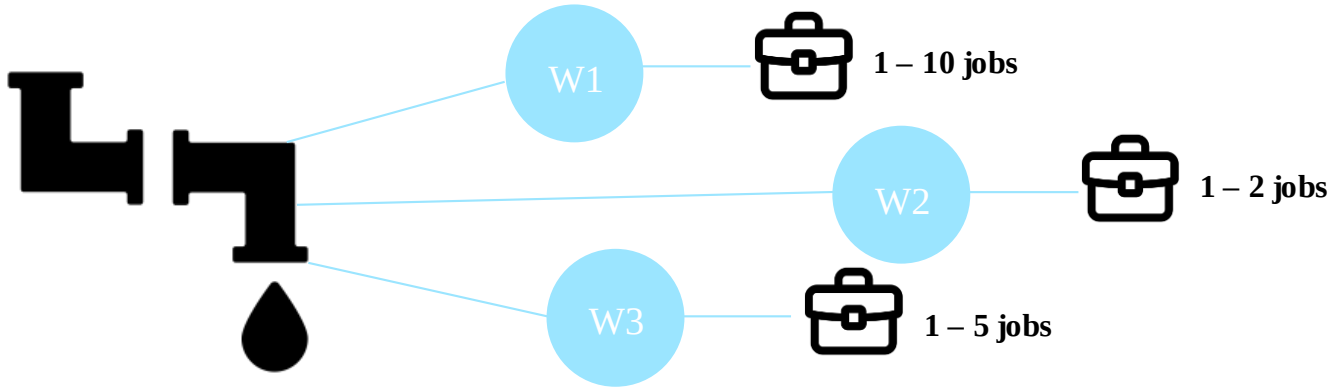
Land Use sector

New potential jobs

Actions in the **Water and sewage management** sector

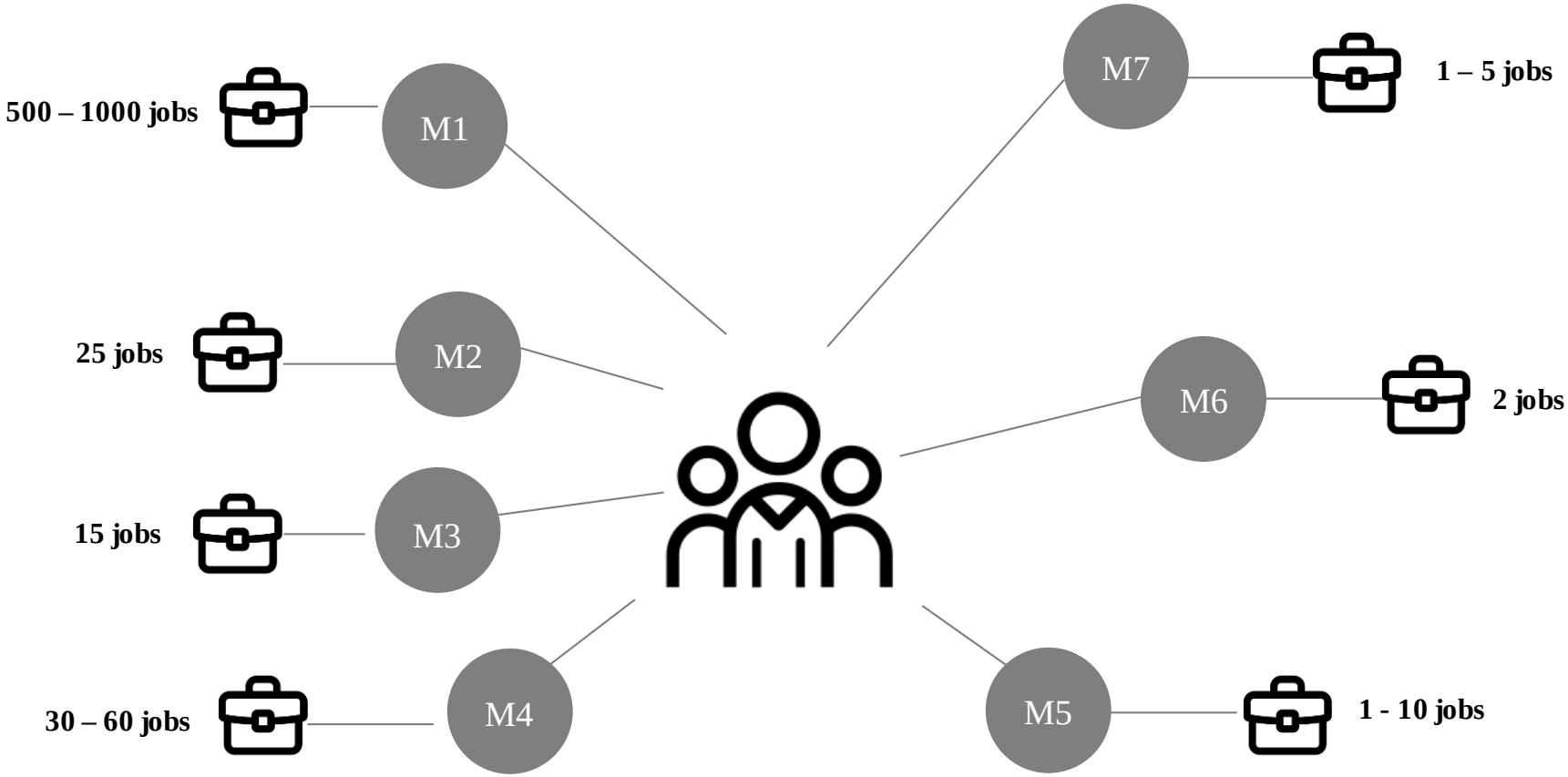
ID	Action	Action type	Pre-investment costs (‘000 EUR)	CAPEX (‘000 EUR)	OPEX (‘000 EUR/year)	Action owner	Timeline 2023	2024	2025	2026	2027	2028	2029	2030
W1	Construction of a municipal water treatment plant	Capital investment	429.5	32,280	37	Wałbrzych Water and Sewerage Company								
W2	Programme for the modernisation and renovation of the city's water and sewerage infrastructure and the construction of water supply and sewerage networks in new areas of the city	Capital investment	73.1	779.1	19.5	Wałbrzych Water and Sewerage Company								
W3	Smart water and wastewater infrastructure management system	Enabling action	n/a	7,945	108	Wałbrzych Water and Sewerage Company								



Actions in the **Cross-sectoral** section

ID	Action	Action type	Pre-investment costs (‘000 EUR)	CAPEX (‘000 EUR)	OPEX (‘000 EUR/year)	Action owner	Timeline
							2023 2024 2025 2026 2027 2028 2029 2030
M1	Promoting advanced forms of training in industry and services	Enabling action	n/a	1,073	n/a	Education and Social Affairs Department	
M2	Creation of the Wałbrzych Centre for Integration of Foreigners	Enabling action	n/a	197	373.4	Education and Social Affairs Department	
M3	Adaptation of infrastructure and teaching facilities in Wałbrzych educational facilities for Ukrainian refugees	Enabling action	n/a	52.7	144.9	Education and Social Affairs Department	
M4	Improving the efficiency of private and public care infrastructure	Enabling action	n/a	5,368	2,238	Education and Social Affairs Department	
M5	Educational campaigns and programmes to raise awareness among residents	Enabling action	n/a	515.4	n/a	Education and Social Affairs Department	
M6	Development of an environmental monitoring and control system using intelligent technologies	Capital investment	n/a	89	39	Environment and Climate Department	
M7	Creating a network of links of tourist attractions in the city	Capital investment	375.8	n/a	n/a	Education and Social Affairs Department	

Actions in the **Cross-sectoral** section

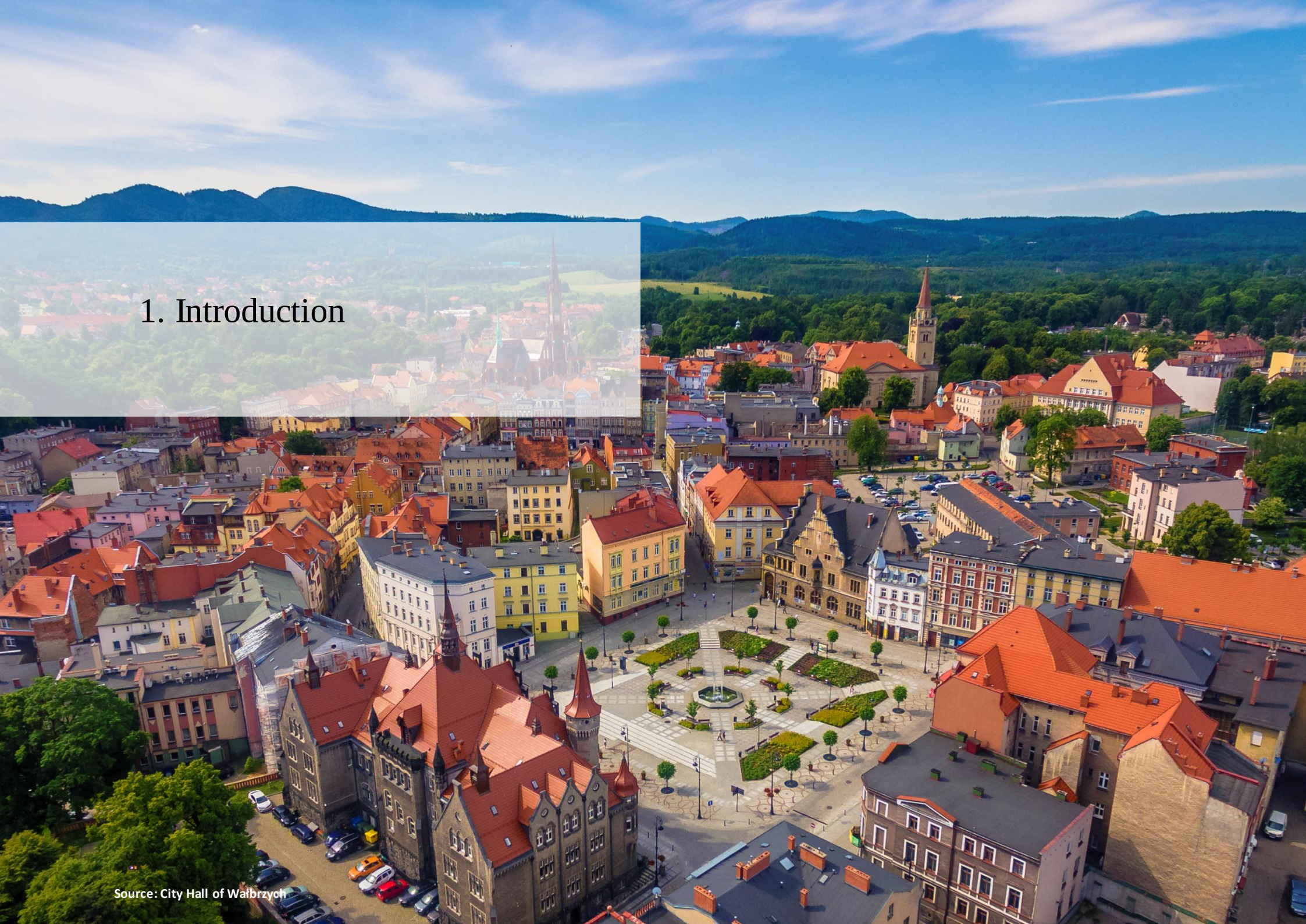


Legend

Cross-sectoral section

New potential jobs

1. Introduction



Source: City Hall of Wałbrzych

1. Introduction

Structure of Wałbrzych Green City Action Plan

The Green City Action Plan is divided into six sections:

Chapter 1. Introduction identifies and defines the main aims and objectives of the document.

Chapter 2. Wałbrzych Green City Action Plan Preparation Approach presents the methodological assumptions, describes the process of preparing the document and stakeholder involvement.

Chapter 3. Assessment of the existing state of the city presents a characterisation of the city's conditions, a socio-economic assessment, a description of the environment and urban sectors.

Chapter 4. Green City Vision and Objectives presents an elaborate vision and a list of goals to support the city in its quest to become a zero-emission, sustainable city, attractive to its citizens.

Chapter 5. Summary of actions provides a summary of the actions developed under the Action Plan, covering the sectors of energy, buildings, transport, waste land use, water and sewage management as well as a number of cross-sectoral actions targeting social issues, education development and tourism.

Chapter 6. Monitoring and reporting implement methods for monitoring the effects and effectiveness of the implementation of the document's objectives.

and appendices:

Appendix 1. Description of Wałbrzych Green City Action Plans actions

Appendix 2. Compliance with existing regulations, strategies and plans

Context

The Green City Action Plan aims to develop a strategic approach to investment planning in the city, as part of a long-term sustainable development strategy, running to 2030. The starting point for planning developments in the city is the transition from a carbon economy and legacy towards a low carbon economy.

The document was prepared with the technical support of the European Bank for Reconstruction and Development and the financial support of the EBRD Technical Cooperation Fund - TaiwanBusiness and the Polish Ministry of Finance.

The methodology developed by the European Bank for Reconstruction and Development was used in the development of the Green City Action Plan. The document is consistent with existing plans, programmes and strategies at international, national, regional and local levels.

It considers assumptions embedded in the 2030 Agenda for Sustainable Development, the Paris Agreement, or the Convention on Biological Diversity (UNCBD). The document is in line with the documents programming the development of the city and the region, such as:

- Territorial Just Transformation Plan for the Dolnośląskie Voivodship 2021-2030. Wałbrzyski Subregion
- Development Strategy of the Wałbrzych Agglomeration with the perspective to 2030
- Low Emission Management Plan 2014-2020 with an outlook to 2030 for the 15 municipalities of the Wałbrzych Agglomeration
- Environmental Protection Programme for the city of Wałbrzych for 2016-2019 with an Outlook to 2023
- Municipal Climate Change Adaptation Plan for the city of Wałbrzych
- Municipal Revitalisation Programme for the city of Wałbrzych for 2016-2025

Developed assumptions

The outcome of the work on the Green City Action Plan is the development of a list of objectives and a set of actions to address the challenges facing Wałbrzych. This will allow a focus on investments covering the city's most important environmental projects to improve the quality of the environment and the lives of residents. The document presents the steps of action with a timetable for their implementation, a financial assessment, indicators for the implementation of the actions, together with an assessment of the benefits of their implementation. In addition, the Action Plan outlines steps for monitoring and evaluating the effects of implementation, as well as recommendations for the broad involvement of municipal and external stakeholders to realise the objectives of the GCAP.

2. Wałbrzych Green City Action Plan preparation approach

Source: City Hall of Wałbrzych

2. Wałbrzych Green City Action Plan Preparation Approach

Preparation process

The preparation of the Wałbrzych Green City Action Plan consisted of four stages, comprising, according to the EBRD's methodology:

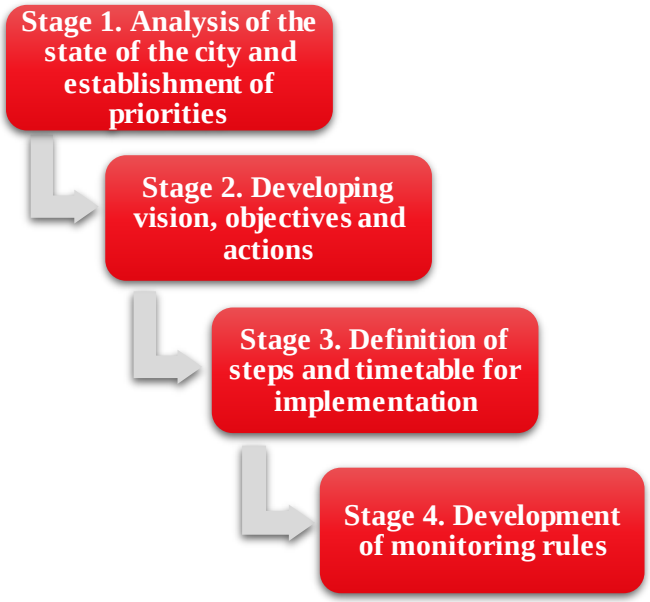


Figure 1 Stages of Wałbrzych GCAP preparations

The process of developing the document considered the priorities and assumptions of documents in force at international, national and local levels. The first three phases were subject to consultation involving a wide range of stakeholders, considering the current and future needs of different social groups - city residents, NGOs, academia, community organizations and city businesses.

Stage 1. Analysis of the state of the city and establishment of priorities

The state of the city analysis phase consisted of collecting data or information on the functioning of the city's sectors and systems, the state of the environment, and the assessment of these resources. Data collection took place in parallel between the consultant team and the municipal units and was complemented by an analysis of data available in national databases or local planning and strategic documents. Information was obtained from government offices, municipal enterprises, published data and reports, and through direct communication with relevant stakeholders. The data collected was cross-referenced with existing standards, so-called 'benchmarks' derived from public data from international organizations such as the World Health Organization, the European Environment Agency and the Inter-American Development Bank. This allowed comparison with quantitative and qualitative indicators of the EBRD methodology on the state of the environment and the performance of the main urban sectors.

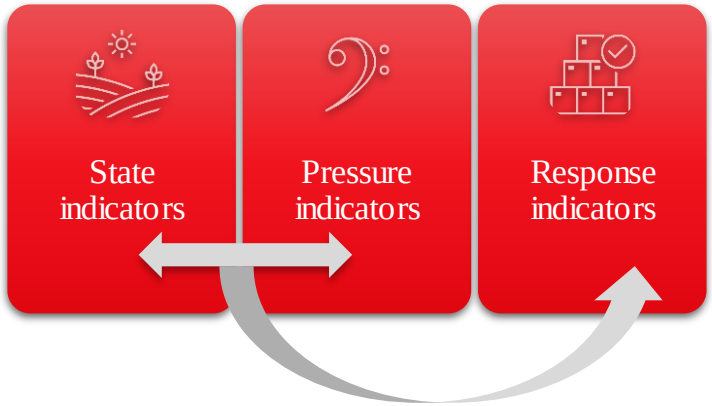
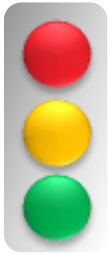


Figure 2 Indicator's categories

A database of 135 indicators was created, which allowed for an efficient assessment of the city's key environmental challenges, based on up-to-date data and information about Wałbrzych. The indicators were divided into three categories:

- **State indicators** indicating the current state of the environment.
- **Pressure indicators** describing urban systems that cause changes in the environment.
- **Response indicators** defining the scope of current investment actions, implemented policies, regulations that counteract negative environmental changes.

Subsequently, all collected data were assessed in terms of quality, considering the criteria: data source (in terms of reliability), geographical coverage (urban/regional/national), data compatibility and range of years. Each indicator was compared to a performance evaluation system using reference values, the so-called **traffic light system** included in the EBRD's Green City Action Plan methodology, as outlined below:



Need for urgent corrective action

Need to improvement

In line with internationally accepted standards

Figure 3 Categories of indicators for assessing the current state of the city

Where data was available for several years, it was possible to identify the trend of the changes taking place in the city to determine whether the value was worsening, improving, fluctuating or stable.
As part of the above analysis, a series of baseline documents were drawn up, which included in detail a description of the existing state of the environment and a technical assessment of the city's sectors, a description of the city's framework and policies and an analysis of participatory urban planning in the city, a vulnerability and risk assessment, a gender assessment, and a Smart City maturity assessment. The completion of the analyses formed the basis for the identification of areas requiring priority action. Fundamental to this process was the engagement of stakeholders and joint discussion of the results of the analyses, followed by agreement on the city's key environmental and sectoral challenges.

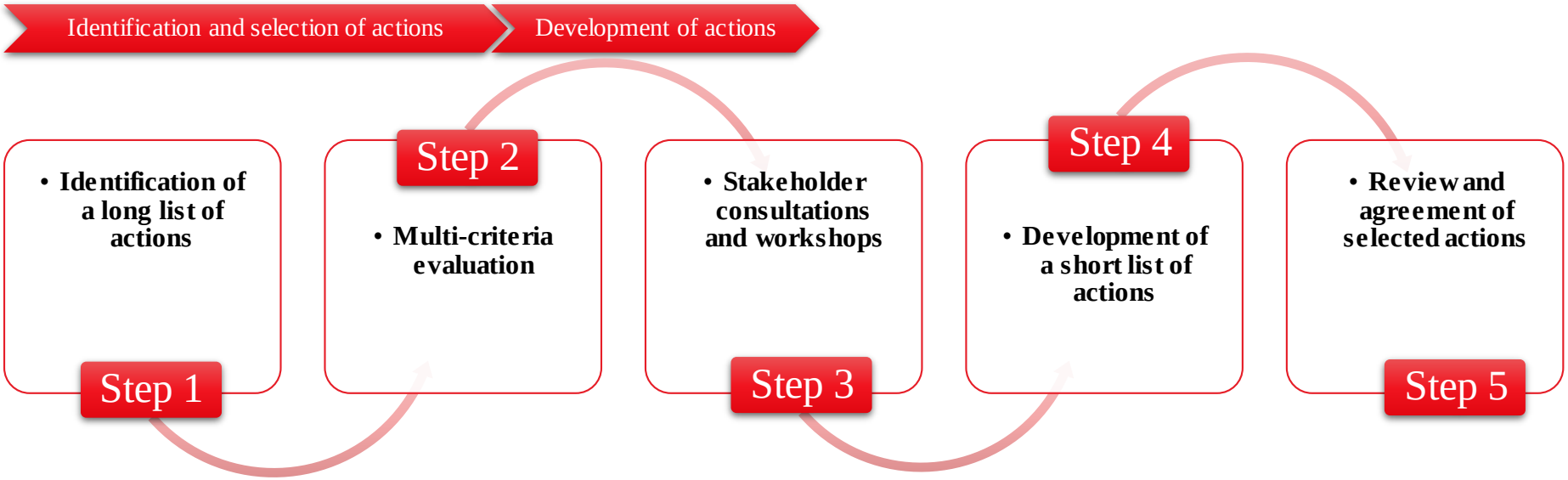


Figure 4 Diagram of the process for developing actions

Stage 2. Developing vision, goals and actions

The development of the vision and objectives took place through a process of extensive consultation with municipal and external stakeholders. The EBRD methodology allows for an in-depth analysis of the city's current environmental challenges and the preparation of actions to address these challenges in line with the long-term visions and objectives identified during the drafting of the document. The environmental, social and financial implications of the proposals were also assessed.

The process of developing short-term actions was carried out in 5 steps:

Step 1. Identification and development of a long list of actions

As a first step, key challenges were identified in key sectors of the city. In order for the city to counter them, a list of actions proposed for implementation was developed in the sectors:

- Energy
- Buildings
- Transport
- Water and sewage management
- Land use
- Waste
- Industry
- Cross-sectoral solutions.

Descriptions of each action have been prepared, considering: the local context, key benefits, links to existing and planned activities in the city.

Step 2. Multi-criteria evaluation

The actions developed were subjected to multi-criteria analysis using three categories assessing whether the actions address the identified environmental problems, allow for inclusivity and social diversity, and contribute to the development of the city's smart potential. The criteria for evaluating the actions are shown in Table 2.

Actions with the lowest scores were excluded from the long list, while those with the highest scores were developed and described in more detail, creating a short list of actions. The actions on the new list were thoroughly discussed in stakeholder workshops, meetings with municipal companies and external stakeholders.

Table 2 multi-criteria evaluation of actions

Environmental criteria	Inclusivity potential	Smart potential
• Development of RES • Reduction of energy consumption • Improvement of air quality • Improving conditions of existing urban resources • Improvement of water and sewage conditions in the city • Increasing the city's potential to adapt to climate change • Industrial development and new investments in new/existing areas • Improving efficiency of waste management • Improvement of the city's integrity	• Tackling social exclusion • Tackling economic exclusion • Tackling gender exclusion	• Potential to implement innovative solutions and smart technologies

Step 3. Stakeholder consultations and workshops

Consultations and workshop meetings were held targeting municipal stakeholders: municipal office, city companies and institutions, as well as external stakeholders: national/regional institutions, associations, NGOs, foundations and representatives of education. This included workshops, panel discussions in thematic groups, dedicated meetings with municipal entities and surveys to gather the voices of diverse community groups. The purpose of the meetings was to discuss and agree on the vision and to assess the relevance of the objectives developed. Following a discussion on the objectives, the scope of the proposed actions planned for implementation was discussed in detail as part of the Wałbrzych Green City Action Plan.

Table 3 Scope of consultations with Stakeholders

The vison	Selection and assessment of the importance of objectives	Discussion of actions
Agree on a vision for the city for 10-15 years, defined in response to the environmental, socio-economic challenges identified during the previous stages of the project.	Identification of key objectives for each identified priority area to be achieved over the next 10 years. Assessment and consideration of environmental and socio-economic criteria (including gender equality and equitable transformation).	Discuss and develop actions that can be implemented in a 5-7 year timeframe, including: » Capital projects » Investment programmes » Enabling actions.

Stakeholders identified a number of solutions needed for implementation and development in the city. They mainly concerned: improving and making public transport in the city more attractive, developing the water treatment system, developing the water and sewage network, increasing energy efficiency and network capacity, modernizing buildings and revitalizing space in the city, and the need for environmental education and raising awareness of residents. The voices of various stakeholder groups were considered at every stage of work on the project and were reflected in the developed actions of the Green City Action Plan.

Step 4. Development and evaluation of a shortlist of actions

As a result of the work, 26 actions were selected, which were evaluated taking into consideration the following elements:

- Description and purpose of action
- Type of action
- Context and justification for action
- Objectives/priorities it pursues
- Timeline and implementation steps
- Action owner and main Stakeholders
- Action benefits
- Enabling policies, strategies and actions
- Performance indicators for outputs/results
- Potential for developing inclusivity and improving social conditions
- Potential to implement innovative and smart technologies
- Mapping of risks, challenges
- Financial appraisal of the actions considering: pre-investment costs, capital expenditure, operating costs, potential forms of savings, funding mechanisms/sources
- Impact on the achievement of the Sustainable Development Goals

Stakeholders contributed significantly to the process of developing and evaluating the shortlist of actions, identifying the specific needs of the city and the opportunities to implement solutions to meet these needs. Collaboration has made it possible to identify city departments and external organizations that can participate in the implementation of the actions.

Step 5. Review and agreement of selected actions

The final crucial step in the development of the Green City Action Plan is the formal adoption of the document at a City Council session and the holding of a formal public consultation, where all citizens will be able to submit their comments and observations.

In the future, the city will involve stakeholders in further development actions. The cooperation of the city with the citizens is important for the next stages of the implementation of the Wałbrzych Green City Action Plan.

Stage 3. Definition of steps and timetable for implementation

As part of the work on the Green City Action Plan, short-term actions were selected that could be implemented in the 2030 timeframe. Within these actions, appropriate investments, capital investments and enabling actions have been identified, and the implementation steps and timeline for their application is made.

Stage 4. Development of monitoring requirements

The final element of the Green City Action Plan is to set out the principles for monitoring and evaluating the progress of implementation. The aim of this process is to check whether the implemented actions and solutions are producing the expected results. To make this possible, the following were defined:

- Reporting and monitoring framework
- Units responsible for preparation and implementation
- Budgeting
- Review and evaluation principles

Stakeholder engagement

Stakeholders played an extremely significant role in the development of the Wałbrzych Green City Action Plan document. They were identified by the Consultant in consultation with the city. Different sectors, representing different interests and social groups at local and national level were considered.

Social diversity and the inclusion of vulnerable groups plays a key role in the selection of stakeholders. Engagement consisted of stakeholder participation at the following stages of the projects:

- Launch of the GCAP development
- Assessment of the existing state and identification of challenges
- Prioritisation of challenges
- Setting vision, goals and actions

At each of these stages, stakeholders were engaged through workshops, online meetings and/or surveys. In total, over ten non-governmental organisations and fifteen municipal and national institutions participated in the city meetings.

The detailed of stakeholder engagement is presented in Table 4. It details the characteristics of the stakeholders involved at each stage of the project, the elements of the engagement process, as well as the results of workshops, meetings and surveys.

Stakeholder groups were represented by:

Representatives of the City

- Mayor and City Treasurer
- City Council
- Municipal Offices
- City planner
- City Gardener
- City Secretary and Press Officer

National/regional insitutions

- Municipal headquarters of the State Fire Service
- Municipal police
- Heating and energy company
- Tauron Dystrybucja S.A. – Office in Wałbrzych
- Institute for Urban and Regional Development
- Automotive companies: Toyota, Faurecia

Municipal companies and institutions

- Intelligent Transport System Centre (ITS)
- InVałbrzych Sp z o.o.
- Wałbrzych Waterworks and Sewerage Company
- Municipal Management of Buildings
- Municipal Public Utilities Company
- Roads, Transport and City Maintenance Management Board in Wałbrzych
- Municipal Social Assistance Centre in Wałbrzych
- Wałbrzych Business Incubator

Associations, NGOs, foundations, education representatives

- Association of Children and Families of the Labour Market
- Joy of Life Association
- Association - More about culture (WOK)
- Vocational Activity Centre Victoria
- Poland Association
- Książ Castle and the Old Mine
- School headmasters, representatives of education
- Members of the Urban Planning Commission
- External advisors to the city

Table 4 Stakeholder engagement process

GCAP stage	Stakeholder engagement	Results	Members	Gender balance	Date
Stage 1. Analysis of the state of the city and establishment of priorities	Inaugural meeting (*Kick - off meeting*)	Presentation of the project in the city and agreement on the principles of cooperation and work schedule	External and internal stakeholders - total of approx. 30 participants	♀ - 43% ♂ - 57%	25 August 2021 (on-line)
	Official launch of the project in the city (*Launch event*)	Introduce the project to external and municipal stakeholders, build relationships and stakeholder engagement	External and internal stakeholders - total of approx. 50 participants Over 100 views on Vimeo	*no data*	19 October 2021 (live)
	Workshops I Assessment of challenges and risks in the city	Identification of the main challenges and problem areas in the city Discussion and assessment of risks in the city Assessment of the city's vulnerability and susceptibility to risks Discussion on counteracting existing risks	Internal stakeholders - approx. 20 participants External stakeholders - approx. 15 participants	♀ - 40% ♂ - 60%	26 November 2021 (live)
	Workshops II Prioritisation of challenges	Agree on priority environmental and urban challenges relevant to the city Prioritising the identified challenges	Internal stakeholders - approx. 20 participants External stakeholders - approx. 15 participants	♀ - 35% ♂ - 65%	7 February 2022 (on-line)
Stage 2. Developing vision, objectives and actions	Workshops III Vision, objectives and actions	Agreeing on a vision Selection and evaluation of objectives for each priority area identified Discussion of actions, collection of feedback and ideas from stakeholders	Internal stakeholders - approx. 17 participants External stakeholders - approx. 10 participants	♀ - 31% ♂ - 79%	21 June 2022 (live)

GCAP stage	Stakeholder engagement	Results	Members	Gender balance	Date
	Survey on vision, objectives and development directions	Gathering opinions and jointly agreeing on the city's vision, goals and directions with the citizens	347 opinions collected	♀ - 66% ♂ - 34%	25 July-15 August 2022 (on-line)
Stage 3. Definition of steps and timetable for implementation	Individual meetings with representatives of the Wałbrzych City Hall, municipal companies and units	Collection of relevant data and information from stakeholders clarifying the actions and needs of the city	External and internal stakeholders - total of approx. 20 participants	*no data*	August-October 2022 (live and on-line)
	Survey on the use of public space and transport in Wałbrzych	Assess the sense of security and availability of services in the city Identify residents' needs to address them	286 opinions collected	♀ - 48% ♂ - 50% 2% - not specified	6-17 October 2022 (on-line)
	Workshops IV Workshops with external stakeholders on actions	Presentation and final agreement on the scope of actions	Internal stakeholders - approx. 26 participants External stakeholders - approx. 15 participants	♀ - 32% ♂ - 51% 17% - not specified	18 October 2022 (live)

3. Assessment of the existing state of the city

Source: City Hall of Wałbrzych

3. City Characteristics

Wałbrzych is located in southwestern Poland, in the Lower Silesian Voivodeship, near the border with the Czech Republic. It is the third urban center in the Voivodeship in terms of area (about 85 km²) and the second in terms of population (about 103,263 inhabitants).[2] The area of the city was historically composed of small mining settlements in the Pełcznica valley and its tributaries, in which silver and other nonferrous metals and black coal were mined. The development of mining of high-quality black coal (anthracite) led to the merger of these settlements into one urban centre in the 19th century. The historically shaped structure of the city is still visible in the geographical arrangements of its individual districts, often separated from each other by narrow parts of river valleys. After World War II, the old districts were supplemented with the centres developed in the north of the city: Piaskowa Góra and Podzamcze. Currently, the city is divided into 18 urban units apart from the two mentioned above, they include: Śródmieście with the most historic character, Podgórze, Nowe Miasto, Biały Kamień, Sobięcin, Książ (with one of the most beautiful castles in Poland and Europe surrounded by a park and forest), Lubiechów, Szczawienko, Poniatów, Rusinowa, Gaj, Konradów, Kozice, Stary Zdrój, Nowy i Stary Glinik.

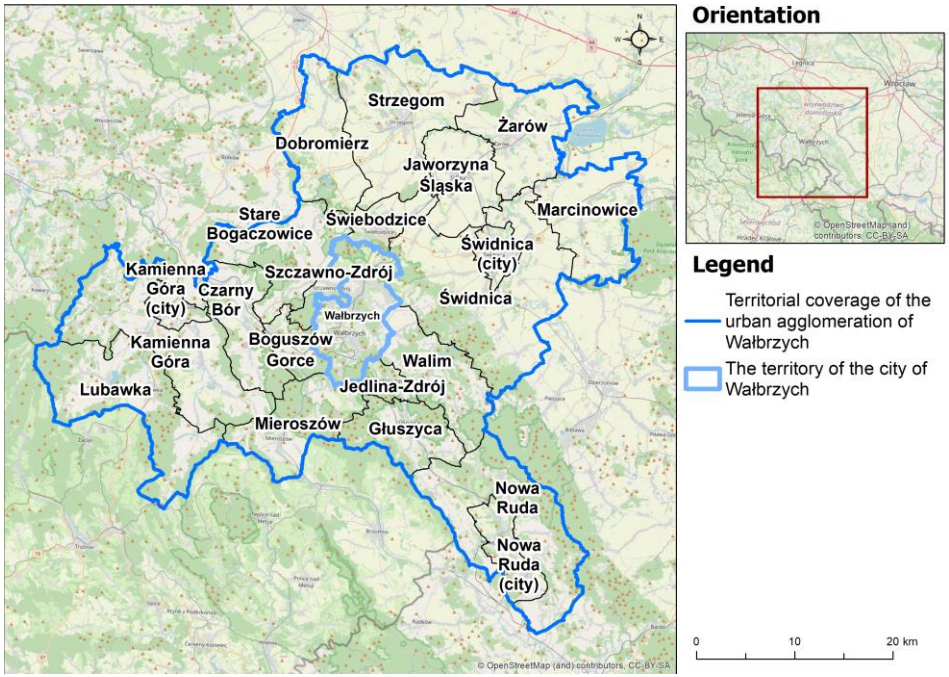


Figure 5 Division of the Wałbrzych Agglomeration

[2] Central Statistical Office - Local Data Bank, as of 31 December 2021.

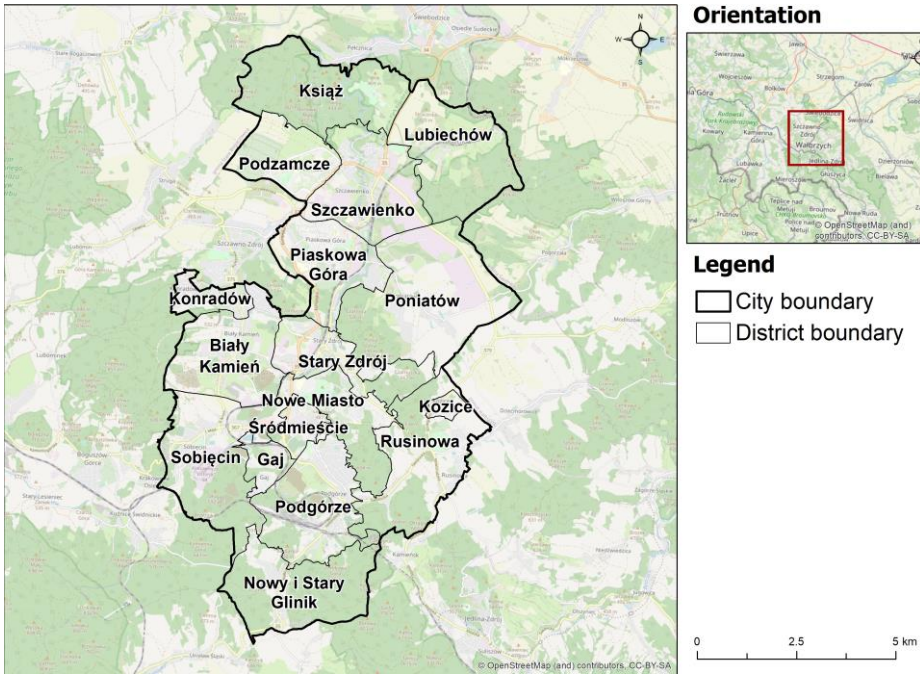


Figure 6 Administrative division of the city of Wałbrzych

3.1 Political and socio-economic characteristics

Administrative structure

Wałbrzych is a city with district rights, the seat of the Wałbrzych county and the main city of the Wałbrzych agglomeration. The city is a local government unit established for the organization of public life on its territory. By virtue of the law, all people living in the city area constitute a self-governing community that pursues its collective local goals. The decision-making and controlling body of Wałbrzych is the City Council, consisting of 25 councilors. The Mayor is the city's executive body, as well as the head of the Department and the official superior of the employees and managers of the city's organizational units. The President manages the work of the Department with the help of the Deputy Mayor, the Secretary, the Treasurer and the heads of the organizational units of the Department.

Obligations

The Municipal Department in Wałbrzych is an organizational unit of the city, that deals with state funds, through which the Mayor performs municipal and county tasks in the field of public administration, resulting from the city's own tasks, tasks commissioned by law or taken over by the city as a result of agreements concluded with other public administration units, as well as contracts with other entities. The tasks of the unit include issues related to finance, environmental protection, society or organization of the department's functioning.

The cells supervised by the Mayor of the city oversee legal matters, crisis management, environmental protection, spatial planning, investments, strategic planning, housing and road transport. The departments of the Deputy Mayor include culture, tourism, communication and health. The city Treasurer oversees all actions related to finances, budget, fees or debt collection. In the scope of the work of the city Secretary, there are other organizational departments, customer service, employee matters and marital status. The units cooperating with the department are educational institutions, support or activity centers, cultural institutions as well as municipal companies, an animal shelter or an intermediary institution for the Wałbrzych agglomeration.

From the perspective of implementing the assumptions of the Wałbrzych Green City Action Plan, particularly important will be the Departments of the City Hall, i.e., the Environment and Climate Department, the Revitalization and Spatial Planning Department, the Transport and Road Traffic Department, as well as the Education and Social Affairs Department. Cooperating companies such as Municipal Facility of Communal Services, Water and Sewage Company, Municipal Building Management, Road, Communication and City Maintenance Authority, will also be important in the implementation of actions.

The next page presents the organizational chart of the City Hall in Wałbrzych along with the presentation of cooperation with municipal and non-urban units and companies.

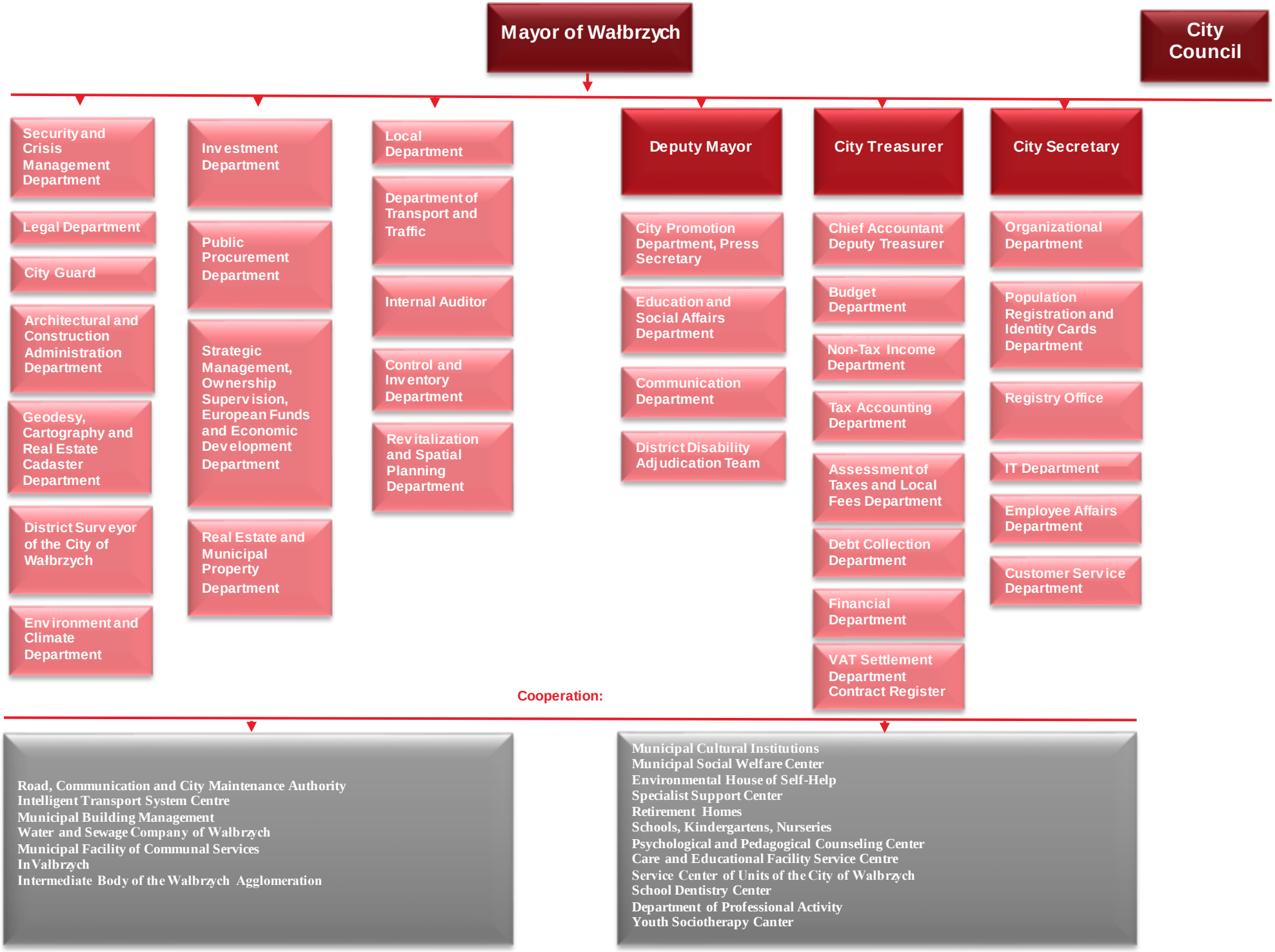


Figure 7 Organisation chart of Wałbrzych City Hall

Demographics

In the years 1995-2020, the number of inhabitants of Wałbrzych decreased by an average of 0.94% per year, from 139,219 in 1995 to 103,263 in 2021.[3] Research indicates that this systematic decline in the population of Wałbrzych is likely to continue, and in 2035 the population of the city may reach up to 89,983 inhabitants.[4] This is related to the current demographic situation – Wałbrzych, like many cities in Poland and in the world, is struggling with the issues of an aging population and population outflow. It is estimated that in 2035 33% of the inhabitants of Wałbrzych will be of post-working age (compared to the current level of 23%). It should be noted, however, that these demographic changes are characteristic of the region and neighboring municipalities, which may indicate broader challenges beyond the city level. Both the decline in the working-age population and the growth of the post-working-age population are likely to be a factor in economic growth. This has an impact on the city's policy, which will require significant development in terms of objectives related to increasing the working-age population and strengthening health and social care. The gradual outflow of people from Wałbrzych should encourage action to increase the demand for housing in the city, as well as to prevent the outflow of current residents. Such solutions include efforts to improve the quality of housing and municipal facilities, expand public services and infrastructure, increase the availability of services and communication channels, or develop more recreation areas, green areas or sports facilities.

As a result of Russian unprovoked war against Ukraine, Poland has experienced a sharp increase in the country's population, and Wałbrzych is one of many cities that have accepted refugees. Currently, 2,300 refugees from Ukraine are registered in Wałbrzych, although it is estimated that more than 4,000-5,000 people from Ukraine have arrived in the city since the beginning of the war crisis (as of May 2022).

Economic context

From the mid-nineteenth century, until the mid-90s, the economy of Wałbrzych was based almost exclusively on heavy industry, and on coal mining, which at its peak employed more than a third of the total population. By the end of the 90s, all Wałbrzych mines were closed, and 14,000 workers lost their jobs. As a result of this, work aimed at attracting investments to the production and service sectors, the Wałbrzych Special Economic Zone "Invest Park" (WSSE) was created, which contributed to the reduction of unemployment from 25% in 1994 to 14% in 2014 and subsequently to 5.5% in 2021. There are 250 companies operating in the WSSE, which have directly created over 65,000 new jobs. Companies operating in the WSSE benefit from tax exemptions, access to built-up land, participation in clusters and assistance in the development of the local labor market. Despite this, there has been a significant decline in recent years (decrease from around 900 registered new businesses per year between 2013 and 2015, to around 700 new business per year between 2016 and 2021) in the registration of new companies in Wałbrzych, which may indicate that actions to encourage the development of entrepreneurship over the last few decades may not have been sufficient to maintain long-term productivity and employment growth.

According to the UN categorization, 52% of all business entities in Wałbrzych are concentrated in the three main sectors: the Construction (1,192), Wholesale and Retail Trade (2,186) and Transport and Warehouse Management sectors (904). Most of the inhabitants work in industry and construction, the percentage of their employment is over 41%. Over 97% of all enterprises operating in the city are micro-enterprises.

City finances

The overall assessment of Wałbrzych's financial situation is good. The city has a stable stream of income from its own sources, with efficient use of EU funds, and a well-managed overall city budget. The city has autonomy to manage policy and budget at the local level, which would help in the

[3] Central Statistical Office - Local Data Bank, as of December 31, 2021.

[4] Demographic forecast for municipalities in the Lower Silesian Voivodship until 2035, 2015

adoption and implementation of the Green City Action Plan, as well as in mobilizing further sources of funding. In recent years, the city has seen an increase in both expenses and income. Currently, this is due to the unstable domestic as well as global market situation, and the city is facing the challenges of a sharp and strong increase in expenditures. Wałbrzych has a public debt of €153 million in 2022,[5] which has the potential to divert public funds from valuable municipal investments and limits the city's ability to incur further debts. Therefore, in a city like Wałbrzych, it is particularly important to identify meaningful and economically viable projects that fit into the city's long-term development plan and can be financed through a combination of public and private funds. In addition to EU subsidies, there is potential to leverage private investment in housing and related city revitalization to improve the fiscal position.

Inclusivity

As part of the preparation of the Green City Action Plan of Wałbrzych, a gender equality assessment was conducted, which considers the needs of the city and its residents, the current state and areas for improvement, in relation to:

- Access to urban infrastructure, with particular emphasis on the safety and accessibility of services for women and mothers with children, persons with disabilities, persons with reduced mobility, the elderly.
- Competences and employment of women and men in urban service sectors.

As a result of the research conducted, no significant gender-related barriers were identified and a high sense of security of both women and men in the use of public areas in the city or the use of public transport was identified. Surveys and meetings conducted in the city indicated the need to constantly raise the awareness of residents in the field of ecological education and actions to improve the availability and quality of services for vulnerable groups. In the development of the city, an extremely important aspect is to raise awareness and ensure inclusiveness and social integration. Below is a summary of the most important aspects and a description of the vulnerability of vulnerable groups and their needs, which should be considered when implementing the actions developed under the Green City Action Plan.

[5] Opinion of the Regional Audit Office 2022

Table 5 Vulnerable groups and their needs that should be considered in the Wałbrzych Green City Action Plan

Vulnerable groups	Group description	Description of the vulnerability to hazards
Elder people	Persons who have reached the general retirement age (from 1 October 2017 it is 60 for women and 65 for men).	According to the data of 2021, Wałbrzych is inhabited by 25,038 elderly people who are 65 years of age and older (9,545 men and 15,493women), which constitutes 24.2% of the entire population of the city,[6] a further upward trend is expected in this regard. This group is particularly vulnerable to the effects of climate change, environmental pollution and extreme weather events such as heat waves, floods and storms. Therefore, it is necessary to efficiently operate the social welfare system, which will ensure the safety of people who are particularly exposed to pressure related to environmental conditions. A number of analyzes indicate that the current system of care for the elderly is insufficient – for example, the Municipal Social Welfare Center pointed to the clear need for Wałbrzych to create new seniors' clubs and nursing homes in order to adapt to demographic trends.[7]
Refugees and migrants	People who moved to Wałbrzych from another country of residence or stay there temporarily in search of shelter.	The Lower Silesian Voivodeship is the fourth largest selection of migrants to live in Poland. However, in connection with Russia's invasion of Ukraine, many refugees appeared in Wałbrzych (4,000-5,000 people from Ukraine have arrived in the city since the beginning of the war crisis),[8] which created new challenges for ensuring good living conditions in the city, responding to the needs of all social groups. As a result of the Russian invasion of Ukraine, the demand for housing, access to education and medical services increased. The development of the situation and the need for additional activities are difficult to forecast. Many people fleeing the war declare their willingness to return. Immigrants often need support places in terms of development, education and settling in in a new environment.
People with disabilities	Persons with long-term physical, mental, intellectual or sensory impairments who, when faced with various barriers, may find it difficult to participate fully and effectively in social life on equal terms with other people.	In 2019, in Wałbrzych, there were over 160 people per 10,000 inhabitants with identified disabilities. These groups should become the main beneficiaries of investment and integration programs, also due to the aging of the society and the anticipated increasing demand for universal infrastructure in the city. According to the Strategy for Solving Social Problems of the city of Wałbrzych for the years 2021-2025, the inhabitants perceive insufficient support for people with disabilities in finding a job or making it easier to move around the city. Therefore,

[6] Central Statistical Office - Local Data Bank

[7] Strategy for Solving Social Problems of the City of Wałbrzych for 2021-2025, Wałbrzych, September 2020.

[8] Data from the city, as of May 2022

Vulnerable groups	Group description	Description of the vulnerability to hazards
		it is necessary to use various methods of activation and integration for people with disabilities. The vulnerability of a social group arises from the risks of climate change due to interacting factors that may limit their ability to react and reduce their resilience to extreme weather events. In addition, people with long-term physical, mental, intellectual or sensory impairments may have difficulty facing and interacting with various barriers that hinder their full and effective participation in society on an equal basis with others.
Homeless people	People in a housing crisis, without a place of residence.	In 2015-2019, the number of homeless people increased from approx. 300 to 350 people, against the increase in the number of people benefiting from financial support and shelter programs. In 2021, 131 homeless people were registered with social welfare institutions.[9] The city runs programs to support the homeless, and activities for this group of people are carried out in the the Municipal Social Welfare Centre. As part of the actions of the Support Center, there are: A shelter for homeless men, a home for mothers with minor children and pregnant women, a heating center for the homeless, a crisis intervention center, sheltered housing, a neighbor assistance center and the "Słoneczny" centre.[10]
Low-income families	Families benefiting from social assistance.	In 2015-2019, the number of low-income families decreased systematically, in line with the general improvement in the economic situation of Wałbrzych. In total, 5295 people and 2,960 families benefited from all forms of social assistance in 2019, compared to 6,011 people in 2018. This group is characterized by low financial and professional security. This means that it is more vulnerable to events that change the demand for labor, including any economic shocks that may result from climate change. This group of people may have unequal access to services such as health care and insurance, which may result in greater difficulty adapting to the effects of climate change and a return to normal functioning. They may also be more susceptible to the effects of air pollution. It should also be noted that the recent spikes in inflation, and in particular the recent increase in energy prices, are contributing to a renewed increase in poverty and financial hardship among lower-income households.

[9] Central Statistical Office - Local Data Bank

[10] Strategy for Solving Social Problems of the City of Wałbrzych for 2021-2025, Wałbrzych, September 2020.

3.2 Environmental baseline

The section provides an overview of the assessment of the existing state of the city, a summary of the indicator data collected in the city and the main findings of the priority environmental challenges and the functioning of urban systems and sectors.

Indicators database

A database of **135 indicators** was developed to analyse and assess the city's existing condition. This provided an overall picture of the current state of Wałbrzych's environment, in line with the methodology of the EBRD's Green Cities Programme. The analysis is based on a set of comparative indicators that help to define a set of key priority areas. All indicators are accompanied by defined benchmarks that allow comparison with a traffic light system comprising green, yellow and red benchmarks.

Among the indicators collected:

- 24 were within the **red** reference range, indicating the need for urgent corrective action.
- 33 were within the **yellow** reference range, meaning that their value needs improvement.
- 50 were within the **green** reference range, i.e., their value is in line with internationally accepted standards.
- 28 were **not compared** with the reference range due to insufficient data to assess them.

Key environmental findings

- Annual CO_2 emissions both per capita and per unit of GDP are in the red reference range.
- High levels of ammoniacal nitrogen (NH_4^+) in surface waters in the red reference range.
- Concentration of particulate pollutants $PM_{2,5}$ and PM_{10} in the yellow reference range.
- Mercury and zinc concentrations in the soil are within the yellow reference range.
- Biodiversity indicators are in the green reference range.
- The indicators for adaptation and resilience to climate change are also in the green reference range.

3.2.1 Air quality

The air quality in Wałbrzych has improved significantly in recent years. This is due to a combination of decommissioning of industrial plants that were a source of pollutant emissions, and appropriate environmental investments have been made in the remaining plants, e.g., at the Viktoria coking plant. In addition, the city has conducted a number of tasks aimed at improving air quality as part of the activities conducted in accordance with the Environmental Protection Programme. Currently, the main sources of air pollution in the city of Wałbrzych are:

- **Municipal sources:** coal fired generation units, individual household furnaces, emitters from public utilities. They have a significant impact on the local state of air pollution and are the main cause of so-called low emissions. They mostly emit dust and gas pollutants.
- **Industrial sources:** from production processes and industrial heat plants.
- **Transport sources (linear):** emissions occur at low altitudes. These are mainly pollution generated by motor vehicles. The most common pollutants are: hydrocarbons, nitrogen oxides, carbon monoxide, dust, lead compounds, sulphur oxides.
- **Secondary dust** from exposed land surfaces.
- Pollution coming in **from outside the city,** depending on the prevailing wind direction.

The main challenge remains emissions of particulate matter and benzo(a)pyrene, mainly from sources of so-called low emissions.

3.2.2 Soil quality

The many years of extraction of raw materials in Wałbrzych, as well as the type of bedrock and the sub-mountainous location, are the reasons for the occurrence of poor-quality soils: podzolic and post-industrial soils developed on reclaimed land. They are mainly acidic and contaminated with sulphur. Mercury, zinc, mineral oil and, to a lesser extent, cadmium is recorded in the soils. Soils of a slightly better-quality class (III) are found in the northern part of the city in the vicinity of the Podzamcze and Lubiechowa settlements and under forests with good forest-forming potential.

3.2.3 Greenhouse gas emissions - mitigation

Mitigation of climate change through the reduction of greenhouse gas emissions is a task that is both set and implemented on a national level Estimates of annual CO_2 emissions for the Wałbrzych sub-region in 2020 indicate emissions of 6.5 million tons of CO_2/year. In comparison, the indicator in Poland's largest city - Warsaw, was around 12 million tons CO_2/year. The main source, responsible for more than 57% of the total emissions, is the energy sector and residential buildings (energy generation and homes heated with coal); despite the implementation of programmes to replace this type of cooker, emissions from this source show only a slight downward trend. The second and growing source of CO_2 emissions is the private transport sector (responsible for almost 15% of these emissions). The largest reduction in CO_2 emissions is observed in the industrial sector (industrial emissions account for about 14% of total emissions)[11].

The city is taking numerous measures related to efforts to reduce greenhouse gas emissions. In 2015, the Low Carbon Economy Plan 2014-2020 with an outlook to 2030 was adopted, which, among other things, aims to reduce greenhouse gas emissions, increase the share of energy from RES and reduce energy consumption. In 2020, the region's authorities signed the Declaration on Decarbonisation, which commits to achieving climate neutrality by 2030. This goal is being implemented through the Wałbrzych Region Decarbonisation Programme funded from the Fair Transition Mechanism.

[11] Territorial Plan of Equitable Transformation for the Lower Silesian Voivodship 2021-2030. Wałbrzych Subregion

It includes, among others:

- Comprehensive modernization of buildings by replacing heat sources.
- Development of local partnerships for RES development, energy storage and building local energy independence.
- Increasing support for the use of heat pumps as a renewable energy source for heating purposes.
- Use of geothermal energy.
- Use of hydrogen, mainly in transport.
- The proposed model for transforming the economy as part of the Wałbrzych Subregion decarbonization strategy is based on the creation of the Wałbrzych Technology Hub (WHT). Within the WHT, it is envisaged that an Energy and Hydrogen HUB will be established, in which projects based on RES (including PV) will be developed, used for the improvement of transport, the chemical synthesis of electricity production, the production of green hydrogen and as a form of energy storage.
- Using hydrogen from electrolysis based on renewable energy sources in bus transport and individual vehicles is one of the elements of the decarbonization programme signed by representatives of 49 Local Authorities of the Wałbrzych Subregion. The project is supported from the national programme "Green Public Transport".

3.2.4 Water quality

The Wałbrzych area is located in the Middle Oder Water Region, in the catchment area of the Bystrzyca and Kaczawa rivers. The area is drained by the Pełcznica River and its tributaries. There are no major water reservoirs in the area, only remnants of fishing ponds, clay ponds and industrial plant settling ponds and artificial retention reservoirs. In a large area of the town, no usable groundwater reservoir has been identified due to changes in water conditions caused by drainage of the rock mass through coal mines. Excavations of former coal mines are gradually being flooded and aquifers previously located within the depression funnel are being rebuilt.

The main sources of water pollution in the Wałbrzych area are municipal sewage, surface run-off from agricultural areas, run-off from industrial areas and landfill sites, and from industrial areas and landfill sites, and unorganized discharges from local sources (from areas without sewerage systems).

3.2.5 Greenery, biodiversity and ecosystems

Areas of high biodiversity surround the city in a ring and are mainly found in the north, south and west of the city. These include landscape parks, protected landscape areas, a nature reserve and Natura 2000 sites. In addition, there are three large city parks, pocket parks and around 70 natural monuments (mainly trees) located in the city. The most valuable habitats are oak-hornbeam forests. There are no major bodies of water within the city. The main river is the Pełcznica flowing from north to south with its main tributaries: Szczawnik and Lubiechowska Woda.

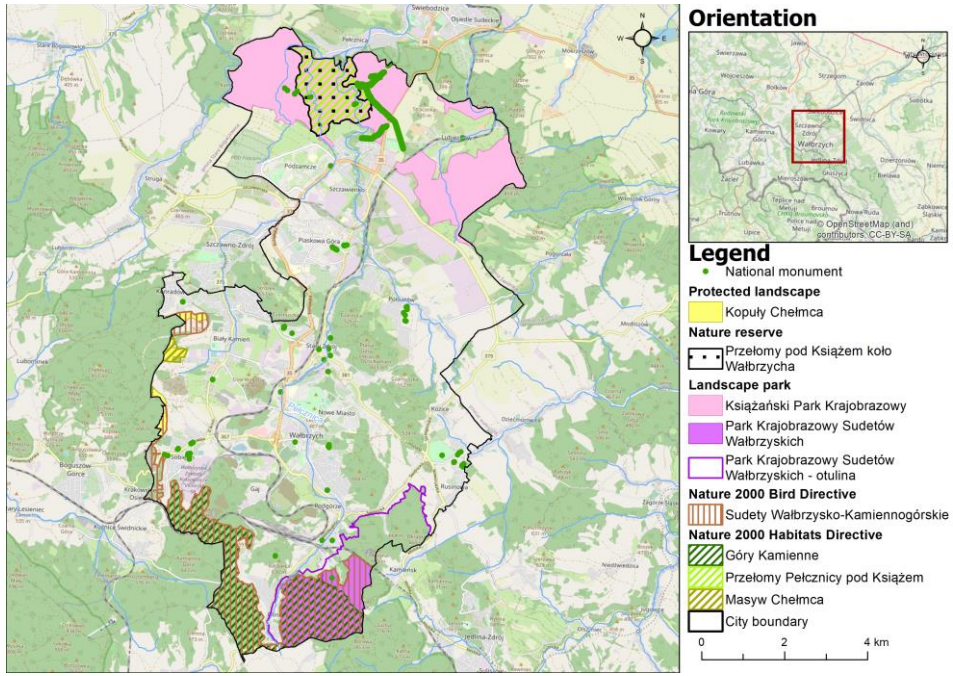


Figure 8 Areas of special natural interest within the city

3.2.6 Adaptation and resilience to risks associated with natural disasters

Exposure to climate change and storm surges is related to the city's location and existing development, including exposure to intense winds, and high temperature amplitudes throughout the year. The optimization of the Fuller River and its tributaries is a cause of rapid water run-off from built-up areas. The city's old infrastructure and buildings are vulnerable to climate risks. Poor soil quality and groundwater depression funnels condition a higher vulnerability to drought, and, at the same time, the high proportion of green areas limits the areas susceptible to heat island formation to the city centre, Podzamcze and Piaskowa Góra. The phenomenon of drought is particularly dangerous due to the decreasing groundwater level in the city, causing problems with drying out of urban greenery or interruptions in the water supply.

The city is actively implementing projects for the deep thermo - modernisation of buildings, the construction of cycle paths, increasing the share of public transport and other measures that contribute to building better resilience and reducing climate impacts, improving the well-being of the city's residents. The City conducts a revitalization program in accordance with the established Municipal Revitalization Program, aimed at integrating the city's planning policy with revitalization activities, with particular emphasis on the housing area. The revitalization policy pursued will allow for the management and reversal of significant degradation of the housing tissue and numerous vacancies, which will contribute to increasing the resistance of buildings and city resources to hazards.

Appropriate units have been established in the city, responsible for monitoring, planning, reacting and removing the effects of hazards, such as: Security and Crisis Management Department in City Hall and Municipal Police. Regular rescue drills are conducted in the city and drills checking the organization of rescue operations related to several types of disasters (e.g., construction disasters), as well as exercises to improve command skills or the principles of cooperation of the State Fire Service with other services during conducting a rescue operation.

The city undertakes projects aimed at increasing the resilience of the city's natural areas to climate change and development in the field of blue and green infrastructure, including a project to create a Municipal plan for adaptation to climate change for Wałbrzych implemented under the project of the Polish Ministry of the Environment 'Development of adaptation plans to climate change in cities with more than 100,000 inhabitants', projects to create pocket parks and rain gardens.

3.3 Sectoral determinants of the city state

3.3.1 Transport

Due to its mid-mountain location and the historical conditions of the city's development, Wałbrzych's transport system is grid-like in nature, with the national road No. 35 and the parallel railway line No. 274 as its axis, located in the Pełcznica River valley. This overloads the system and consequently results in congestion along the main axis and on the approaches to it, limits the efficiency and attractiveness of public transport and threatens to block the transport system in the event of a major accident or disaster in land traffic.

At the same time, due to the neglected state of the railway infrastructure and its limited offer and reduction of its offer, as well as the liquidation of tramway and then trolleybus transport in the post-war period, the share of individual (car) transport in the mobility structure of inhabitants has seriously increased, while the public transport system has been based on bus transport.

Intensive efforts to change the above pattern have been initiated in recent years with the opened Western Bypass of Wałbrzych, an external ring road system, development of a network of bicycle paths, partial implementation of the "Intelligent Transport System in Wałbrzych" (ITS) programme and optimization and modernisation of the public transport system.

The city has a relatively substantial number of (dated) vehicles, which contributes to air pollution, greenhouse gas emissions and congestion. Further development of public transport modes in the city and the creation of incentives to use public transport or cycling can partly reduce the negative impact of transport on air quality in the city.

3.3.2 Buildings

According to the 2019 Land Use Study, approximately 50% of all buildings in Wałbrzych are in poor or extremely poor technical condition, which translates into their energy efficiency. Electricity consumption in the city is relatively high, as is heat consumption. This is due to low public awareness of the benefits and costs of supplying electricity and heat from various sources. In addition, many properties use outdated sources (inefficient coal fired generation units) that are fired with low-quality fuel.

The process of thermal modernisation is also a major challenge. While most city-owned buildings have undergone the modernisation process, many single-family or private buildings have still not undergone this process. The main reasons for this are the low environmental awareness of the public about the need for thermomodernisation and the costs of such investments. The situation is also complicated by the advanced age of the buildings, which are often under the supervision of a conservation officer, which increases the challenge compared to newer buildings.

Typical characteristics in the way buildings are heated include the relatively low share of district heating. Only 50% of the city's area is covered by a district heating system supplied by two district heating plants. The development of the district heating network is limited on the one hand by the hilly terrain, which raises the costs of network development, and on the other hand by the structure of the buildings in the city - characterised by a high proportion of single-family or multi-family houses and a low proportion of multi-family housing estates. Connecting individual consumers to the district heating network is costly and generally uneconomic.

3.3.3 Industry

From the mid-19th century, Wałbrzych was a heavily industrial city, with coal mining developing particularly well. However, at the end of the twentieth century there were significant changes and all the mines were closed, which translated into social problems - high unemployment and a mass exodus of residents from the city. To counter the problems, in 1997, the Wałbrzych Special Economic Zone was established. There are currently more than 250 companies operating there, with a total investment of more than PLN 30 billion since 1997. Over 65,000 jobs have been created there (in total, in the Zone). Numerous automotive companies operate in the Zone, including Toyota, Mercedes, Volkswagen, Umicore, Ronal, NSK Steering Systems, but also manufacturing companies, e.g., CERSANIT. Some industrial activities are conducted outside the zone. These include the likes of a porcelain factory, a coking plant, and clothing factory. A total of 2,172 enterprises were operating in the city in 2021, which declared industrial and construction activities in the PKD (Polish Classification of Activities) classification.

3.3.4 Municipal waste

The city of Wałbrzych has a contract for the collection of municipal waste with Municipal Utilities Company (pol. *Miejski Zakład Usług Komunalnych sp. z o.o.*, MZUK). The Company operates a Segregation and Waste Management Facility in the rank of Municipal Installation in the city, which consists of: Segregated Municipal Waste Collection Centres in Wałbrzych at Beethoven and Stacja Streets, a Mechanical-Biological Processing installation, a landfill for non-hazardous and inert waste at Beethoven Street in Wałbrzych (in the reclamation phase, currently does not accept waste).

The plant receives waste produced by residents of the city and from neighbouring municipalities. Biodegradable waste from the city of Wałbrzych is managed at installations for the processing of selectively collected green waste and other bio-waste, composting plants, a biogas installation and an EU-compliant landfill.

The installations are located in the surrounding towns: Zawiszów, Ścinawka Dolna, Bielawa and Świdnica. The city carries out investments and programmes to improve the state of waste management by, among other things, implementing educational campaigns, running a website: *www.rewolucjasmieciowa.Wałbrzych.eu*, a system of penalties and fines for non-compliance with certain rules on segregation or waste management. A

Selective Municipal Waste Collection Centre is a specially prepared, equipped and supervised place, located in a place accessible to residents, where residents can transfer selectively collected waste free of charge, Residents can transfer waste such as used batteries and accumulators, electronic equipment, bulky waste, clothing and textiles, waste from renovation and demolition, etc., to the point where it is collected.

3.3.5 Energy

The city does not have its own sources of electricity and is powered by the national electricity grid. The distribution network within the city is operated by a distribution company serving the southwest of Poland. The city needs to deepen and develop cooperation with local operators. In terms of heat supply, the city has two district heating plants and numerous smaller coal fired generation units. Unfortunately, only 50% of the city's area is covered by a district heating system supplied by two district heating plants. The rest of the city is heated from individual sources, which results in significant air pollutant emissions from so-called low emissions. It is necessary to modernise these sources and to raise public awareness of the consequences of using outdated and non-ecological heat sources. The city is committed to the development of renewable energy sources through plans to build a photovoltaic farm, but preparatory actions will be required to achieve the stated ambitious climate neutrality targets. Also, with regard to RES, it is necessary to build public awareness of the need for their development and the effects of climate change.

3.3.6 Water and sewage management

Intakes of surface and groundwater are located mainly outside the city boundaries. Wałbrzych is characterised by a high degree of connection of its inhabitants to the water and sewage network - approx. 97.4% (2021). It is one of the highest rates in the Lower Silesian Voivodeship. The Wałbrzych municipal water supply also supplies the neighboring towns with water.

Sewage from most of the Wałbrzych area is directed through the sanitary sewage system, mainly to the mechanical and biological sewage treatment plant in Ciernie (Świebodzice). It is a treatment plant with increased removal of nutrients. In 2021, 82.4% of residents used the sewage network[12]. The rest of the residents had individual tanks.

Typical flood hazards related to the discharge of water from the riverbed sporadically occur in the city, mainly in the Szczawnik bed and in the Lubiechów district. The Pełcznica and Szczawnik catchment area is mountainous, with sudden floods, which, combined with an exceptionally large, sealed city surface, results in rapid fluctuations in the level and volume of the flow. The city aims to reduce the risk of flooding by increasing the retention of the Pełcznica river and the Szczawnik stream.

[12] Central Statistical Office - Local Data Bank

3.3.7 Land use

In the structure of use of Wałbrzych, investment and construction areas account for over 30%, with the dominant share of residential areas constituting approx. 8%, and industrial and service areas, approx. 5% of the city's area (data from 2018). The highest population density is in the following urban units: Podzamcze and Piaskowa Góra, and in the following areas: Biały Kamień, Nowe Miasto, Śródmieście, where multi-family housing is predominant. The city is remarkably diverse in terms of the distribution of functions. The only contemporary spatial area with a uniform character and function is the Economic Zone (typically industrial character of buildings). Wałbrzych has a relatively diversified development structure, resulting from the connection of subsequent settlement units to it. Śródmieście has much older buildings. With the collapse of the mining industry and the deteriorating economic situation, there was a gradual degradation of the urban structures of post-industrial areas, post-mining and residential areas.

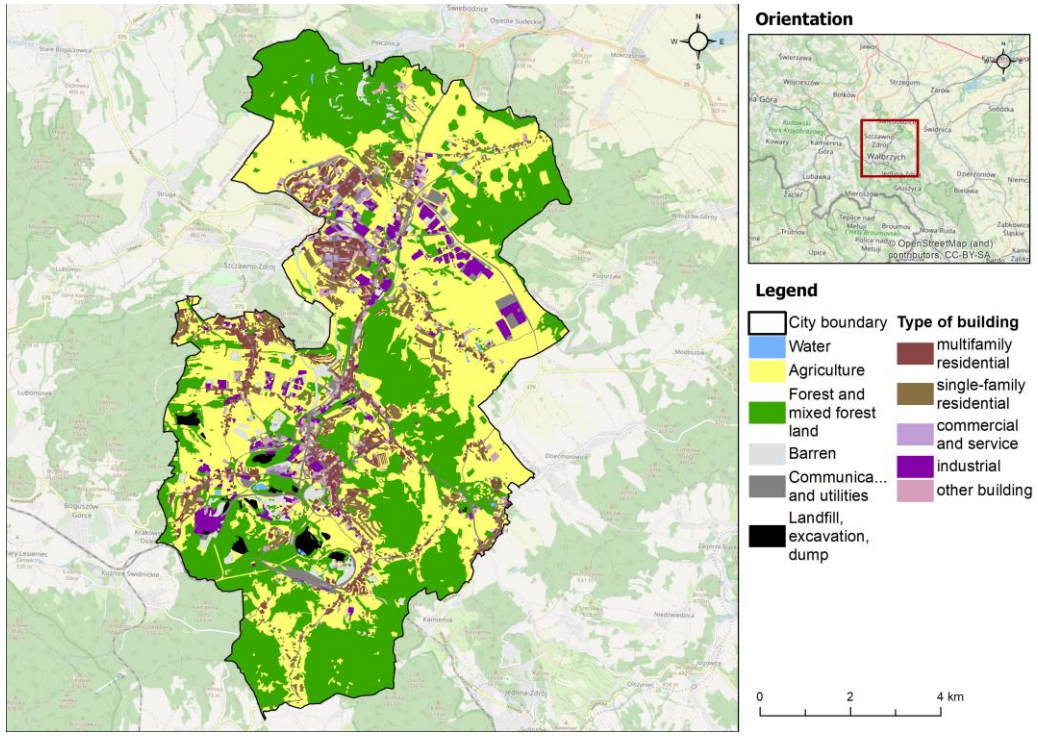


Figure 9 Wałbrzych forms of land use

3.4 Summary of the baseline assessment

Table 6 Summary of indicator assessment

Green indicators	Yellow indicators	Red indicators
Air quality *Concentration of PM_{10}, SO_2, NO_x*	**Air quality** *Concentration of $PM_{2.5}$*	**Mitigation (GHG emissions)** *CO_2 equivalent emissions per capita and per unit of GDP; Annual CO_2 emissions per GDP unit*
Soil quality *Concentrations of cadmium, mineral oils in soil.*	**Soil quality** *Concentrations of mercury, zinc in soil.*	-
Water reservoirs, drinking water *Biochemical oxygen demand (BOD5); Water samples complying with national potable water quality standards; Wastewater treatment*	**Water reservoirs, drinking water** *Potable water supply*	**Water reservoirs, drinking water** *Ammonium nitrogen (NH4+) concentration in rivers and lakes; Domestic water consumption per capita*
Transport *Share of the total fleet of passenger cars run by energy/alternative fuel; Kilometers of bicycle path; Share of population having access to public transport*	**Transport** *Fuel standards for light passenger and commercial vehicles; Transport modal share in total trips Motorization share*	**Transport** *Average age of the car fleet; Percentage of diesel cars; Transport modal share in commuting*
Buildings *Fossil fuels consumption for heating and cooling in public buildings*	**Buildings** *Electricity consumption in buildings; Annual fossil fuels consumption for heating and cooling in commercial buildings*	**Buildings** *Electricity consumption in residential and commercial buildings; Fossil fuels consumption; Share of buildings with green and energy certification*
Solid waste *Waste treatment*	**Solid waste** *Waste generation and collection*	
Greenery and biodiversity, land use *Open green space area per capita; Share of parks, green areas, residential green areas and protected areas within the city limit; Proportion of the population living within 20 minutes to everyday services*	-	**Land use** *Vacancy rates of commercial and residential buildings*
Industries *Percentage of industrial wastewater that is treated according to applicable national standards* ***Adaptation and resilience to disaster risks*** *Percentage of public infrastructure and households at risk.*	-	-

3.5 Identified sectoral challenges

Transport

- Encourage the use of low-emission collective transport.
- Prioritization of bus and bicycle transport along with limiting car traffic.
- Emphasis on promotion and convenience of using collective transport.
- Increasing the resilience of the city's transport systems to sudden events that may disrupt its operation.

Water and sewage management

- Rationalization of water resources management in the city.
- Maintaining the best possible water quality and preventing pollution.
- Upgrading and expanding the sewerage network as well as wastewater management facilities.
- Increasing flood resilience through appropriate land management and improving the rainwater drainage system.

Municipal waste

- Improving the waste collection system through the PSZOK.
- Prevention of wild waste dumps.
- Environmental education of residents on waste segregation, collection and reduction.
- Normalising the management of post-industrial waste on private land.
- Improving waste treatment and disposal technologies.

Buildings

- Increasing the share of electricity from RES and improving electrical efficiency in residential and commercial buildings.
- Conducting thermo-modernisation of buildings and developing standards or incentive systems for thermo-modernisation.
- Raise public awareness of energy efficiency in buildings.

Industry

- Attracting investors with an environmentally friendly business profile (companies whose operations do not adversely affect the natural environment) to the city and the Special Economic Zone.
- Further development of industry and new technologies while ensuring appropriate environmental and municipal management standards.

Land use

- Ensuring a high quality of housing through the urban design of the city.
- Carrying out the reclamation of brownfield sites and their use to create new leisure and nature areas.
- Improving the conditions of the existing municipal resources.

Energy

- Upgrading the cable energy distribution network with lower failure rates.
- Addressing the large scale of individual heat sources.
- Development of RES within the city and building public awareness in this area.

3.6 Prioritisation of challenges

The analysis of environmental challenges and needs identified in individual sectors made it possible to identify priority areas in which the implementation of actions will help to improve environmental conditions, the living conditions of the inhabitants, and the quality and efficiency of the city's infrastructure. The key challenges identified on the basis of the analyses and workshop discussions include:

- Air quality
- Surface water pollution and access to water
- Mitigating climate change
- Water, greenery, biodiversity and ecosystems
- Soil quality
- Adaptation and resilience to disaster risks

- Modernisation of energy sources and development of RES
- Reduction of low emissions
- Improving energy efficiency
- Reclamation of post-industrial sites
- Provision of own and low-cost drinking water resources
- Improvement of the sanitary and stormwater drainage network system
- Development of rainwater retention areas
- Improving urban integrity (development, transport, smart)
- Reduction of wild dump sites
- Improving the conditions of the existing municipal resources
- Further development of industry and new investments in the city

3.7 Just transition

The Just Transition concept focuses on achieving a fair and equitable transition of formerly coal-dependent societies towards climate-resilient and low-carbon economies, including supporting those who stand to lose economically. The just transition ensures environmental sustainability as well as decent work, social inclusion and poverty eradication. The just transition is an integral part of many of the global commitments adopted by countries, such the Paris Agreement. The just transition concept links to 14 of the 17 Sustainable Development Goals, explicitly drawing together SDGs: climate action (12), reduced inequalities (10), decent work and economic growth (8), and affordable and clean energy (7).

The areas of the Wałbrzych subregion are affected by the effects of the unfinished transformation - the negative legacy of the coal transformation visible in the landscape of the subregion is the high degree of decapitalization of housing resources.

To mitigate the results of the transition legacy Wałbrzych in cooperation with other local government officials of the Wałbrzych Subregion and non-governmental organizations applied to the Voivodship with a Social Territorial Plan for Just Transition of the Wałbrzych Subregion. the main challenges and opportunities of implementing the Just Transition concept, both in the Subregion and the city of Wałbrzych, is presented in the table on the right (

Table 7).

The challenges of Wałbrzych are aligned with the regional, although the municipal challenges are detailed and more directly show the areas of improvement need by Wałbrzych.

Table 7 Key opportunities and challenges related to implementing the Just Transition concept

Wałbrzych Subregion	City of Wałbrzych
Key challenges:	***Key challenges:***
» Total reduction of the sub-region's estimated annual balance of total CO_2 emissions by 6.5 million tons by 2050, » Creation of approximately 7,000 additional jobs in green or climate-neutral sectors by 2030 and 37,000 jobs by 2050, » Performing adaptation and mitigation works to climate change, including 400 ha of degraded areas of heaps after hard coal mining activities.	» Implementation of technologies, systems and infrastructure ensuring affordable clean energy, energy storage, reduction of greenhouse gas emissions, development of renewable energy sources and improvement of energy efficiency, including for the purposes of reducing energy poverty, » Revitalization and decontamination of degraded areas, restoring functions to post-mining areas, changing land use, » Investments in the development of entrepreneurship and innovation leading to economic diversification and job creation, including in the field of sustainable tourism.
Main opportunities:	
» Achieving the decarbonisation of energy-intensive sectors of the economy and the elimination of low emissions in single-family, residential and municipal buildings and housing communities, as well as the implementation of zero-emission public transport or introducing solutions towards energy self-sufficiency, » Obtaining support for small and medium-sized enterprises in developing their competitiveness, developing an innovative economy based, among others, on smart specializations, building competencies to perform the professions of the future, investments in digitization, digital connectivity, and smart mobility, » Reculturing valuable natural areas, restoring biodiversity.	

Given the nature of the Green City Action Plan the process involved broad involvement of municipal and external stakeholders, who were not only indicating and discussing technical and infrastructural challenges but also focused on the needs of residents, providing a suitable place for work, development and leisure. As previously mentioned, many of the historical labour challenges in Wałbrzych have stemmed from the mine closures of the 1990s, which led to a significant deterioration of business conditions and massive increases in the rate of unemployment at that time. By 1993, 50% of employment still relied on coal including 7,251 miners and 24,000 associated jobs such as sponsored crèches, canteens, community centres and other activities. When the mines closed, little funding or support was provided to manage the transition to a new economy. Unemployment rose from below 6% in the early 1990s to 28% by 2002. Nowadays the unemployment rate in Wałbrzych is at 5.9% in 2020 (7.3% among women and 4.7% among men). In the period 2010-2020 in the Walbrzych poviat, the percentage of unemployed people aged 35-44 and 45+ significantly exceeded unemployment among younger people. According to most of the city interviews, there is a shortage of skilled workers for employment among the unemployed, but there is a demand for them on the market. Actions such as retraining and training can help minimise the unemployment rate among the population aged 35+.

In order to facilitate access and create an encouraging and engaging environment for the youngest, the role of the Internet in their lives should be emphasised and reflected in the way the actions are implemented. It is necessary to ensure that all the training, courses and other activities to encourage sustainable lifestyles proposed in the document are available on a transparent virtual network accessible to all.

Wałbrzych due to the coal legacy was fully dependent on this source also in terms of energy. The fossil fuel transition is ongoing but having in mind the city's ambitious plan for the development of Wałbrzych and the Subregion towards coal-free in the energy and heating sectors in 2030, with a 55% reduction in CO_2 emissions in 2030 and climate-neutral in 2040, more immediate and efficient actions need to be implemented by the city. The actions which were identified within the GCAP process are addressing this issue. This may allow the city to accelerate the transition and GCAP has also in a major focus on the climate change adaptation and mitigation works, as well as on revitalization of degraded post-industrial areas.
The actions suggested in the GCAP will be tackling the challenges of the Just Transition application in the regional and local context as shown in the graphic below (the bolded actions are aligned with the Wałbrzych Just transition application challenges).

Figure 10 GCAP actions alignment with the Just Transition reginal and local challenges (marked bold text)

Creation of new jobs in green or climate-neutral sectors	Reduction of annual CO_2 emissions	Adaptation and mitigation works to climate change
		
• **T4 Developing the potential for use of green hydrogen in the city** • **T5 Promotion of zero-emission transport** • **O1 Smart municipal waste management system** • **W1 Construction of a municipal water treatment plant** • **M1 Promoting advanced forms of training in industry and services** • **M7 Creating a network of links of tourist attractions in the city**	• **E1 Construction of PV farms in the city** • **E2 Development of local heat sources based on RES. Intensification of the use of green energy** • **B1 Further modernization of the district heating system** • **E3 Modernization of the distribution network** • **B2 Creating a program of deep thermal modernization and revitalization of municipal buildings in the city** • **B3 Tackling energy poverty** • T4 Developing the potential for use of green hydrogen in the city • T5 Promotion of zero-emission transport	• **B2 Creating a program deep thermal modernization and revitalization of municipal buildings in the city** • **U1 Further developmer of pocket parks and the protection and restoration of valuable land in the city** • **U2 Revitalization and decontamination of degraded areas** • W2 Programme for the modernisation and renovation of the city's water and sewerage infrastructure and the construction of water supply and sewerage networks in new areas of the city • W3 Smart water and wastewater infrastructure management system • M5 Educational campaigr and programmes to raise awareness among resident • M6 Development of an environmental monitorin and control system using intelligent technologies

The total number of 26 actions combined result in up to nearly 1500 potential jobs in the operation phase of the actions and additional workplace during construction phase. Although the construction will rather be developed by skilled professionals and will not create new workplaces it will give potential extra revenue for the construction companies in the region.

Table 8 Estimated number of jobs and emission reductions as a result of the implementation of the actions

Estimation of potential jobs in all GCAP actions	Total estimated reduction of CO_2 (tCO_2/year)
825 - 1524	100,498.41

4. Green city vision and objectives

Source: City Hall of Wałbrzych

4. Green city vision and objectives

The green city vision, developed for the period of 10-15 years, portrays the desired future of the city's development and is the essence of determining the objectives and actions of the Green City Action Plan. The development of the vision and objectives was preceded by a thorough analysis of the current state of the city in the areas of environment, economy and infrastructure as well as social aspects, followed by the identification of priority challenges. The vision and objectives were agreed upon during the third workshop in the city and the survey of inhabitants.

City Vision

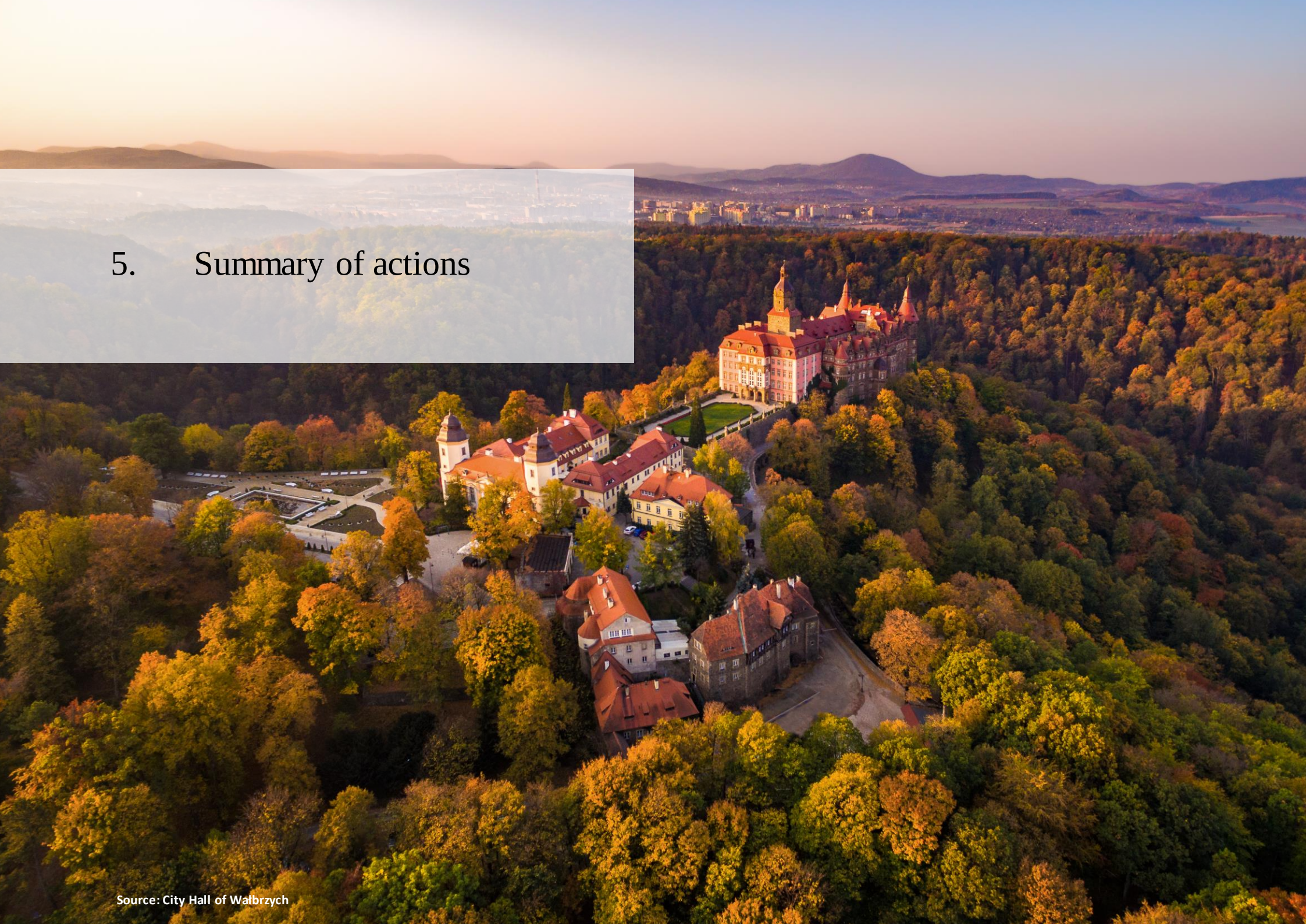
Wałbrzych will be a zero-emission city, implementing the assumptions of sustainable development, attractive to residents, providing them with appropriate conditions for development, work and leisure, where high natural values are preserved, blue-green infrastructure is implemented and takes care of the cultural heritage, creating ideal conditions for the development of future generations.

Objectives of Green City Action Plan

Objectives of Green City Action Plan

Acronym	Objective	Sector
C1	Aiming for decarbonization and achieving climate neutrality	Energy
C2	Implementing strategies aimed at reducing emissions from low height emitters	Energy, Buildings
C3	Increasing the energy efficiency of infrastructure and buildings	Energy, Buildings
C4	Providing accessible, high-quality services, social housing infrastructure	Energy, Buildings
C5	Supporting sustainable, safe and integrated transport	Transport
C6	Improving the functioning of urban infrastructure through the development of innovative technologies and digital transformation	Transport
C7	Improving the spatial planning with protection of land through constant revitalization and decontamination of degraded areas	Land use
C8	Adaptation and increase of the city's resilience to climate change	Land use
C9	Development, effective use and protection of the city's water resources	Water and sewage management
C10	Improving and strengthening the city's water and sewage management	Water and sewage management
C11	Strengthening the ecological awareness of the citizens and improving the quality of selective waste collection	Waste
C12	Building a strong and aware local community and social activation	Industry

5. Summary of actions



Source: City Hall of Wałbrzych

5. Wałbrzych Green City Action Plan actions

5.1 List of actions

Energy

E1 Construction of PV farms in the city

E2 Development of local heat sources based on RES. Intensification of the use of green energy

E3 Modernization of the distribution network

Buildings

B1 Further modernization of the district heating system

B2 Creating a program of deep thermal modernization and revitalization of municipal buildings in the city

B3 Tackling energy poverty

Transport

T1 Improving the public transport and the ticketing system

T2 Development of bicycle infrastructure in the city

T3 Development of the ITS system

T4 Developing the potential for use of green hydrogen in the city

T5 Promotion of zero-emission transport

Waste

O1 Smart municipal waste management system

O2 Municipal system of selective waste collection and recycling

O3 Circular waste management

Land use

U1 Further development of pocket parks and the protection and restoration of valuable land in the city

U2 Revitalization and decontamination of degraded areas

Water and sewage management

W1 Construction of a municipal water treatment plant

W2 Programme for the modernisation and renovation of the city's water and sewerage infrastructure and the construction of water supply and sewerage networks in new areas of the city

W3 Smart water and wastewater infrastructure management system

Cross-sectoral actions

M1 Promoting advanced forms of training in industry and services

M2 Creation of the Wałbrzych Centre for Integration of Foreigners

M3 Adaptation of infrastructure and teaching facilities in Wałbrzych educational facilities for Ukrainian refugees

M4 Improving the efficiency of private and public care infrastructure

M5 Educational campaigns and programmes to raise awareness among residents

M6 Development of an environmental monitoring and control system using intelligent technologies

M7 Creating a network of links of tourist attractions in the city

5.2 Actions in Energy Sector

Key conditions

In recent years, there has been a particular increase in the use of RES in Poland due to the economic efficiency of such projects. The development of RES in Wałbrzych will increase the city's self-sufficiency in terms of energy generation. Furthermore, an existing distribution networks are characterised by lack of capacity, high failure rates and vulnerability to weather conditions, which may pose a significant problem due to climate change and the occurrence of extreme weather events. A significant part of the city is supplied from 23 local heating plants powered by natural gas in 100%, with a total installed capacity of 5.448 MW. Currently, households mostly use low-efficiency coal-fired furnaces (also heating appliances of outdated construction - such as coal fired generation units without the possibility to regulate the fuel fed or the air supplied to the combustion process), which results in significant air pollutant emissions from low emissions, which are characterised by particularly harmful effects on human health. The lay of the land is a challenge in the development of electricity grids and RES due to currently increased construction and operating costs.

Implemented activities

The city is involved in the Wałbrzych Energy Cluster which aims to support the development of renewable energy technologies, increase the awareness of energy consumers, promote and support innovation in RES.

The city supports and encourages participation in national programmes that support RES, such as the Clean Air Priority Programme. The Just Transition Plan to invest in the implementation of technologies and systems and infrastructure to provide affordable clean energy, energy storage, reduce greenhouse gas emissions, develop RES and improve the city's energy efficiency, including for energy poverty reduction.

The city has also developed a project for 2023-2026 "Construction of infrastructure for the generation and storage of energy from solar radiation and biogas in the area of the Wałbrzych Energy Cluster and partner municipalities". It will be implemented in the area of 6 communes: Jedlina-Zdrój, Głuszyca, Stare Bogaczowice, Szczawno-Zdrój, Walim and Wałbrzych. The project includes the construction of photovoltaic farms with a total capacity of approximately 14 MWe, the construction of energy storage facilities with a total capacity of approximately 4 MWe, the construction of a biogas plant with a capacity of approximately 1 MWe and the modernization of the street lighting system. The assumed project implementation schedule covers the third quarter of 2026. The estimated value of the project is PLN 90 million.

The city is currently preparing an investment concept as part of the "Decarbonisation of buildings and municipal infrastructure in the municipalities of the Wałbrzych Agglomeration" programme for the development of energy audits and the "Warm flat" programme, consisting of the replacement of heat sources and thermo-modernisation based, among other things, on heat pumps.

Wałbrzych Green City Action Plans actions

Three capital investments have been prepared to develop renewable energy installations within the city, to create a plan for the city's heat supply using green energy, and to upgrade the electricity grid to ensure it has adequate capacity and is ready for the connection of new RES capacity.

Below is a summary of the planned actions for the energy sector. A detailed description of the actions can be found in **Appendix 1. Description of Wałbrzych Green City Action Plans actions.**

Table 9 Summary of actions in the Energy sector

ID	Action	Type	Description
E1	Construction of PV farms in the city	Capital investment	Implementation of investments to develop renewable energy installations with a total minimum capacity of 20 MW.
E2	Development of local heat sources based on RES. Intensification of the use of green Energy.	Capital investment	Update of the "Plan for heat, electricity and gas fuels supply for the city of Wałbrzych." Expansion and modernisation of the district heating system and moving away from coal as a fuel used to produce heat energy.

E3	Modernization of the distribution network	Capital investment	Upgrading the existing electricity grid to increase its efficiency and capacity and its ability to connect new RES capacity by a minimum of 40 MW.

Action implementation

In order to build photovoltaic farms in the city, it will be necessary to consider the lack of sufficient distribution network capacity in the city and to develop infrastructure and technology for the storage of surplus generated energy.

In addition, the city should develop an interdisciplinary feasibility study for a hybrid surplus energy storage system at the pumped storage power station in the Copernicus Shaft area.

The field of heat energy, plans start with the development of an updated "Plan for the supply of heat, electricity and gas fuels in the city of Wałbrzych". The solution for improving the efficiency and increasing the availability of the district heating system in Wałbrzych will be a low-temperature district heating network system for which a pilot programme is planned. Another step is the development of RES in the thermal power industry, this is to be achieved by changing the power sources of the city's heating plants to biogas boilers, heat pumps and a cogeneration system. In addition, the replacement of overhead pipes and networks with district heating networks with pre-insulated pipes will increase their efficiency.

In order to implement RES energy generation actions, it will be necessary to implement the construction of a substation and upgrade the existing network to increase its capacity and stability. In addition, the parallel development of a system/database - or application - for tracking energy consumption and cost-effective planning of domestic energy use will be beneficial in terms of plans to make the city as energy efficient as possible.

Financing route

The costs presented here are the sum of the expenditure of each cost category, within one sector.

Pre-investment costs:

- PLN 30,883,000 (EUR 6,632,100)

CAPEX:

- PLN 476,225,000 (EUR 102,269,300)

OPEX:

- PLN 7,543,800 (EUR 1,620,000)

Financing mechanisms / source:

- Own resources of the city and state
- EU financial support programmes
- Just Transition Fund
- Own funds of enterprises investing in RES under the ESCO or public-private partnership formula
- Loans, credits, green bonds

Implementation barriers / challenges

- A major constraint to the development and construction of new photovoltaic farms throughout Poland is the lack of capacity of the distribution network, which consequently leads to investors failing to obtain conditions for the connection of new RES generation sources.
- The terrain (hills) may hinder the development of electricity, heat and gas networks and increase construction and operating costs. It may also affect the possibility to develop only selected RES technologies.

Roles and partnerships

The implementation of actions within the energy sector will be coordinated through the Environment and Climate Department, whose tasks include cooperation with other units and entities in the field of the city's energy policy, renewable energy sources and low-carbon economy. It is important to involve the Wałbrzych Energy Cluster in the implementation of the cluster's tasks and expert cooperation. As part of the implementation of the actions, cooperation with Tauron Dystrybucja S.A. – Office in Wałbrzych, the company that distributes electricity in the city, will be crucial.

As the main supplier of heat energy, Thermal Energy Company in Wałbrzych will be an essential partner for the implementation of district heating measures due to its management of 2 heat plants in the city - coal and gas. The company additionally owns 23 small local heating plants fully powered by gas.

5.3 Actions in Buildings sector

Key conditions

The actions described in this sector contribute to the objectives:

- C2 - Implementing strategies aimed at reducing emissions from low emitters
- C3 - Increasing the energy efficiency of infrastructure and buildings
- C4 - Providing accessible, high-quality services, social and housing infrastructure

Currently, the electricity consumed in the city is highly carbon-intensive, and the city has identified a need for investment in renewable energy sources. During autumn and winter there is smog from low emission sources, which translates into high concentrations of particulate pollution PM_{10} (20,0 µg/m^3) and $PM_{2,5}$ (13,0 µg/m^3). Residents largely use outdated coal fired generation units fed by poor-quality fuel. The energy inefficiency of buildings results in the largest share of this sector in atmospheric greenhouse gas emissions in the city. Connecting individual consumers to the district heating network is characterised by low profitability due to the terrain and urban conditions. There is also the problem of energy poverty in Wałbrzych. Energy poverty[13] means a situation in which a household run by one person or several persons together in a self-contained dwelling or in a single-family building cannot provide itself with sufficient heat, cooling and electricity to power appliances and for lighting. In order to counteract it, it is necessary to take measures for the thermal modernisation of buildings and to improve their energy efficiency.

Implemented activities

A programme from EU funds, 'Replacement of high-emission heat sources in buildings and dwellings in selected municipalities of the Wałbrzych Agglomeration', is being conducted in the city until the end of 2022. About 300 subsidies have been granted from the programme until now. In addition, the municipality of Wałbrzych has been consistently implementing heat source replacement programmes on its own budget since 2014 (1,314 subsidies granted).

The city implements programmes to thermally modernise municipal and community buildings on an ongoing basis. By 2022, the city has conducted 70 investments aimed at the thermomodernisation of residential buildings, 13 of which have been conducted on a group of buildings listed in the register of historical monuments.

Wałbrzych Green City Action Plans actions

The actions developed include the identification of new potential mechanisms for financing investments under existing urban development programmes and support for households facing energy poverty. It also assumes the development of detailed standards for the conduct of thermal modernisation actions in buildings in the city.

[13] https://ibs.org.pl/app/uploads/2016/12/IBS_Working_Paper_09_2016_pl_streszczenie.pdf

Below is a summary of the planned actions for the buildings sector. A detailed description of the actions can be found in **Appendix 1. Description of Wałbrzych Green City Action Plans actions**.

Table 10 Summary of actions in the Buildings sector

ID	Action	Type	Description
B1	Further modernization of the district heating system	Capital investment	The action envisages the creation of a special fund to continue the implementation of the programme "Replacement of high emission heat sources in buildings and dwellings in selected communes of the Wałbrzych Agglomeration".
B2	Creating a program of deep thermal modernization and revitalization of municipal buildings in the city	Capital investment	Develop a set of standards/good practices for the deep thermo-modernisation and revitalisation of municipal buildings in the city, energy consumption standards, covering: public buildings, schools, administrative and recreational facilities, as well as historic buildings and other types of city-owned housing.
B3	Tackling energy poverty	Capital investment	Creation of a dedicated fund for households at risk of energy poverty.

Action implementation

Energy actions focus on individual energy sources to eliminate low emissions. In order to achieve this goal, the plan is to set up a fund to continue the programme of replacing high-emission heat sources. In terms of supporting the energy efficiency of buildings, a general set of standards for thermo-modernisation and revitalisation of buildings should be developed, which should then be introduced as part of a programme of deep thermo-modernisation of municipal buildings. To ensure a long-term perspective and efficiency, ongoing fundraising for new programmes related to energy efficiency upgrading of buildings is envisaged.

An in-depth analysis should also be carried out on the incidence of energy poverty in the city and actions should be implemented to enable the fund and the subsidy programme for the poorest to be launched. Once the subsidies have been awarded, the city should implement monitoring and control of how the subsidies are spent by residents to ascertain the effectiveness of the programme.

In addition, it is planned to support Thermal Energy Company with the installation and assembly of a water heat accumulator to store surplus heat that can be distributed when residents' demand for heat energy increases. The accumulator will be able to compensate for the operation of the cogeneration plant on a daily basis, making it possible to increase production in cogeneration.

Financing route

The costs presented here are the sum of the expenditure of each cost category, within one sector.

Pre-investment costs:

- PLN n/a (EUR n/a)

CAPEX:

- PLN 768,533,000 (EUR 165,042,500)

OPEX:

- PLN n/a (EUR n/a)

Financing mechanisms / source:

- National Reconstruction Plan
- Program European Funds for Infrastructure, Climate, Environment 2021–2027
- Own funds of the city and the state
- Loans, credits, green bonds

- PolSEFF Program (Polish Sustainable Energy Financing Facility)

Implementation barriers / challenges

- The hilly terrain of the city, implying higher network extension costs.
- A substantial proportion of single-family and multi-family houses, requiring action directly from the owners, and connecting individual consumers to the district heating network is expensive and generally not cost-effective.
- Making the process of thermo-modernisation of buildings more difficult, due to the high investment costs, the low environmental awareness of the inhabitants and the advanced age of the buildings, which are often subject to the supervision of the conservation officer.

Roles and partnerships

As part of the implementation of the assumed actions, the most important entities responsible will be Thermal Energy Company in Wałbrzych in terms of modernising the district heating system, together with the Environment and Climate Department and Municipal Building Management in terms of continuing the programme for replacing high-emission heat sources.

Municipal Building Management will also take on tasks related to thermomodernisation and revitalisation of municipal buildings, together with the Offices of the City Hall of Wałbrzych, i.e., Revitalization and Spatial Planning Department, Organizational Department, Education and Social Affairs Department, the Real Estate Management and Municipal Property Department and the Local Department.

The Organizational Department of the City Hall of Wałbrzych will be responsible for the funds allocated for combating energy poverty, together with the Education and Social Affairs Department and the Municipal Social Welfare Center in Wałbrzych.

5.4 Actions in Transport section

Key conditions

In terms of transport, the following objectives are assumed:

- C5 - Supporting environmentally friendly, safe and integrated transport
- C6 - Improving the functioning of urban infrastructure through the development of innovative technologies and digital transformation

Currently, the city's public transport system is bus-based. However, residents largely use individual transport, often characterised by significant emissions due to the age structure of vehicles and the dominance of vehicles with combustion engines. On the city's main thoroughfares, a significant deterioration in traffic conditions (congestion, reduced transport fluidity) is observed during the morning and afternoon peak. There is a systematic increase in the length of the network of cycle paths in the city area (an increase of approx. 25% in the last 3 years), however, the route of the paths is adjusted much more to the needs of recreation than everyday use for commuting to workplaces and services.

Implemented activities

In 2022, the city produced a "Project for the optimal reorganisation of the Wałbrzych public transport network", which set out a concept for changes to the layout of the transport line network. At the same time as adapting, rebuilding and renovating roads, the city tries to modernise bus stops. 170 bus stops within the city are equipped with bus shelters (60% of the total) and 51 of them with Dynamic Passenger Information (DIP) boards (18% of the total). Wałbrzych has an app that facilitates travel, trip planning and travel, however, without the possibility to purchase tickets. Tickets can be purchased on dedicated mobile apps. Wałbrzych is currently developing a plan for the development of cycle paths in the city, which accurately identifies the needs in this area. The city is actively working on and raising funds for similar investments - in 2022 it put forward a project under the National Recovery Plan to improve the connectivity of the areas of the Wałbrzych Special Economic Zone with the rest of the city. An electric scooter rental system has been operating in the city since February 2022. The development of a network of cycle paths, combined with the possibility of renting bicycles and electric scooters, will popularise active mobility in the city. The city conducted a project together with PKN Orlen related to the construction of a hydrogen filling station. Hydrogen sourced from the planned station will be able to power public transport in the city.

The city currently has an ITS system in place, which includes a mobile information system and portal, an area traffic control system with priority for public transport vehicles, a CCTV monitoring system, public transport management systems, passenger information, and traffic control. In addition, a system for paying for parking and public transport using debit, credit or smartphone cards is being implemented in Wałbrzych.

Wałbrzych Green City Action Plans actions

Actions in the transport sector include the further development of the ITS system within the city, through bus traffic prioritisation, a road safety system, the implementation of a traffic model on the street network to improve the quality, comfort and efficiency of individual and public transport travel. A more optimal use of the transport network through guidance on alternative routes and constant access to traffic data will provide the opportunity for efficient traffic management and the prevention of congestion or inefficiencies. The expansion of the passenger information system and the replacement and modernisation of bus shelters will improve the comfort of travel and intensify the use of public transport as well as the greenery at bus stops, resulting in improved environmental conditions in the city. The development of cycling infrastructure will have a positive impact on the health and safety of residents, as well as increasing active mobility using environmentally friendly modes of transport. Investment in low-emission vehicles and infrastructure adapted to them will have a positive impact on air quality and the reduction of greenhouse gas emissions.

Below is a summary of the planned actions for the Transport sector. A detailed description of the actions can be found in **Appendix 1. Description of Wałbrzych Green City Action Plans actions**.

Table 11 Summary of actions in the Transport sector

ID	Action	Type	Description
T1	Improving the public transport and the ticketing system	Capital investment	Extension of passenger information system, replacement and modernisation of bus shelters.
T2	Development of bicycle infrastructure in the city	Capital investment	Development of cycling infrastructure within the city.
T3	Development of the ITS system	Capital investment	Further development of the Intelligent Transport System throughout the city.
T4	Developing the potential for use of green hydrogen in the city	Capital investment	Conducting research, analysis and studies on the use of hydrogen in the city, developing hydrogen infrastructure and implementing pilot programmes.
T5	Promotion of zero-emission transport	Capital investment	Creation of a local infrastructure network of electric vehicle charging stations in the most attractive tourist areas and charging stations for batteries in electric bicycles and scooters.

Action implementation

Actions in the transport sector include an integrated set of steps which, when implemented, will achieve a coherent and efficient transport system for the city. As part of the optimisation of the transport network, the introduction of an ITS system will require an analysis of needs and opportunities and then supervision of its development and operation in the city. In order to increase the convenience of using public transport, it is planned to implement DIP systems as part of modernising public transport stops.

An important aspect is to encourage residents to use other means of transport than individual vehicles. This can be achieved not only by taking care of the public transport infrastructure, but also through a system of cycle paths and shelters. The introduction of green hydrogen in the city's operational areas will require research, analysis and feasibility studies, as well as the development of infrastructure to enable its use in vehicle propulsion. Once the infrastructure is in place and the research has been conducted, it is

planned to implement a pilot programme for the purchase of hydrogen buses, which will also be used to promote the city by linking buses to key attractions. In order to promote zero-emission transport, it will be necessary to develop technical documentation, and obtain permits for the development of electric vehicle charging infrastructure. The next step would be to build a network of electric vehicle charging stations in the most attractive tourist areas and to build charging points for electric bicycles and scooters.

Financing route

The costs presented here are the sum of the expenditure of each cost category, within one sector.

Pre-investment costs:

- PLN 950,000 (EUR 204,000)

CAPEX:

- PLN 189,489,200 (EUR 40,692,800)

OPEX:

- PLN 56,628,600 (EUR 12,161,000)

Financing mechanisms / source:

- National Recovery Plan
- European Funds programme for Infrastructure, Climate, Environment 2021–2027
- Just Transition Fund
- Own funds of the city and the state
- Loans, credits, green bonds
- Norwegian Funds
- HORIZON Europe

Implementation barriers / challenges

- In association with the cooperation and future investment plans of PKN Orlen, the city has the potential to produce green hydrogen. There is a need to create energy storage facilities, build hydrogen refueling stations, which will allow the use of purchased hydrogen-cell buses.
- Landforms that restrict the development of active mobility.
- The need to adapt transport infrastructure in line with the principles of universal design, with particular attention to the needs of people with disabilities, people with reduced mobility, the visually impaired, the elderly, mothers with children.
- Convince of residents to individual versus collective transport.

Roles and partnerships

In terms of improving transport systems, the responsibility will be on the Road, Transport and City Maintenance Authority in Wałbrzych (here: Roads Authority) in Wałbrzych, together with the City Promotion Department and the Revitalization and Spatial Planning Department, to create a universal transport system with wide accessibility, including the replacement of bus shelters and bus stop infrastructure. The city and local transport operators should also establish cooperation with commercial companies offering public transport trip planning services, between any point in the city (development of a mobile app). The Roads Authority, together with the Transport and Road Traffic Department and the City Promotion Department, are also responsible for actions aimed at expanding cycling infrastructure within the city. Investment in the basic transport infrastructure will allow cooperation with commercial companies offering electric bicycle and scooter rental services to be intensified. In terms of ITS-related actions, the responsible entity is the Intelligent Transport System Centre in Wałbrzych, with the support of stakeholders from the Roads Authority and the Transport and Road Traffic Department. The introduction of hydrogen transport and the corresponding infrastructure as well as the promotion of zero-emission transport is the responsibility of the Roads Authority together with the City Promotion Department, the Silesian Bus Consortium and the Transport and Road Traffic Department. Regarding the development of hydrogen infrastructure, it will be important to continue cooperation with PKN Orlen. The city has held a series of negotiations through which a set of investment targets was established. As a result, a letter of intent was signed to cooperate

on the development of zero-emission public transport based on hydrogen propulsion.

5.5 Actions in Waste sector

Key conditions

The objective to be achieved for waste management in the city is:

- C11- Strengthening the ecological awareness of the inhabitants and improving the quality of selective waste collection

The city provides weekly municipal waste collection to 91% of its population. The overall indicators of the city's waste management system have shown an increase in waste recycling in recent years, along with a decreasing amount of solid waste, indicating a growing environmental awareness among residents. Despite this, it is still considered necessary to educate residents on segregation, selective waste collection and waste separation "at source". Incidents of illegal rubbish dumps, burning waste in private cookers to heat the building as well as illegal extraction and lack of management of post-industrial waste from private land are noted in the city. In order to improve the city's waste collection system, it was identified that there was a need for an investment to install around 600 new waste shelters.

Implemented activities

The municipality collects waste in a selective manner, with the following fractions being used: glass, paper, metal and plastics, green waste and ash and slag from household furnaces. The municipality has equipped single-family properties and small communities with the bags necessary for the collection of selectively collected waste. The remaining properties use bins and containers set up in sheds and waste bins. In addition, quarterly collections of waste electrical and electronic equipment are conducted directly from residents. In 2020, 16 specialised red containers were installed in the city for the collection of electrical and electronic equipment. Also in the same year, the City Council included in the waste management system unoccupied properties where the activities of the City Council and its organisational units, as well as cultural and sports institutions co-organised by the city, are conducted.

The city implements investments and programmes aimed at improving waste management, e.g. through the implementation of educational campaigns (e.g. lessons at the PSZOK (selective waste collection centre) site, the 'Stop Plastic' campaign, developed information materials for residents), the operation of the www.rewolucjasmieciowa.Wałbrzych.eu website, a system of penalties and fines for non-compliance with specific principles of waste segregation or management, and the operation of two PSZOK points. The PSZOK is a specially prepared, equipped and supervised place, located in a place accessible to residents, to which residents may transfer selectively collected waste free of charge, such as: used batteries and accumulators, electronic equipment, bulky waste, clothing and textiles, waste from renovation and demolition, etc.

Currently, 10 green waste sheds have been building in the city, there is a further need to develop the infrastructure for waste collection.

Wałbrzych Green City Action Plans actions

Actions have been proposed for the facilitation and popularisation of the waste management system, including educational activities. The actions envisage the launch of an intelligent system of individual segregation for multi-family housing, which would improve the level of recycling and selective collection, increase resource efficiency through the re-use of items and raise awareness among residents through education. In addition, the installation of 600 new rubbish bins on the main arteries connecting the different districts, the creation of repair points for used electrical and electronic equipment, and the introduction of electronic Problem Waste Collection Vehicles, the so-called SZOP, were also proposed. These actions will reduce the incidence of illegal dumping and the creation of so-called 'wild dumps' and enable the reduction of environmental pollution through properly organised collection of hazardous waste from households. In order to support and finalise the construction of a holistic closed-circuit waste management system, it is proposed to develop the infrastructure for waste recovery and neutralisation together with the accompanying areas, i.e., the transport base, office and social facilities.

Below is a summary of the planned actions for the Waste sector. A detailed description of the actions can be found in **Appendix 1. Description of Wałbrzych Green City Action Plans actions**.

Table 12 Summary of actions in the Waste sector

ID	Action	Type	Description
O1	Smart municipal waste management system	Capital investment	Design, delivery and start-up of a comprehensive Individual Municipal Waste Segregation System for multi-family housing in the city. Implementation of pilot programmes, a mobile application and assumptions of the "Wałbrzych closes the loop" campaign.
O2	Municipal system of selective waste collection and recycling	Capital investment	Installation of new refuse shelters, the creation of 'Repair Café' points and the purchase of electric cars to collect problem waste.
O3	Circular waste management	Capital investment	Completing the modernisation of the waste management infrastructure in Wałbrzych by finalising the construction of a holistic circular waste management system.

Action implementation

The actions include the purchase of mechanical waste collection equipment, installation and launch of an IT system for municipal waste management, primarily for the largest settlements, i.e., Piaskowa Góra and Podzamcze. As part of the system, it is planned to implement a free mobile application, which is to, among other things, remind of the waste collection deadline, inform of changes to the waste collection schedule, enable the reporting of irregularities by indicating the GPS location and attaching a photo. The city aims to introduce the principles of a circular economy through ongoing educational campaigns, but also through the development of waste management infrastructure facilities. The action envisages the selection of locations and development of land for the construction of new facilities, as well as the comprehensive construction of new halls with installations for the recovery and disposal of waste, together with a transport base and welfare facilities. The installation of additional waste sheds can help to achieve a high degree of quality in waste management. The creation of repair points and the support of the system through the purchase of cars responsible for the collection of problematic waste in the city will also have a positive impact on improving the sector. Initially, the city will purchase 4 specially marked cars covering a designated route through the city, on selected schedule.

Financing route

The costs presented here are the sum of the expenditure of each cost category, within one sector.

Pre-investment costs:

- PLN n/a (EUR n/a)

CAPEX:

- PLN 244,485,000 (EUR 52,503,200)

OPEX:

- PLN 4,320,000 (EUR 927,700)

Financing mechanisms / source:

- National Reconstruction Plan
- European Funds for Infrastructure, Climate, Environment 2021–2027
- Own funds of the city and the state

Implementation barriers / challenges

- Local conditions and the lack of communal plots of land, especially in single-family developments where private properties predominate, make it difficult to erect containers for separate municipal waste collection in new locations

Roles and partnerships

The entity responsible for the implementation of waste management tasks in the city is the Environment and Climate Protection Department, in cooperation with Municipal Utilities Authority in Wałbrzych, which has the infrastructure for waste collection and segregation, as well as the Education and Social Affairs Department in carrying out educational actions.

5.6 Actions in Land Use sector

Key conditions

Within the actions in the land use sector, objectives are planned to be achieved:

- C7 - Improving spatial order along with land protection through constant revitalization and decontamination of degraded areas
- C8 - Actions to adapt and increase the city's resilience to climate change

Wałbrzych is characterised by a large area of green space, however, due to the industrial character of the city there are also many degraded post-industrial areas including buildings, tanks, settling ponds or post-mining dumps. The total area of degraded post-industrial sites in Wałbrzych is 4,681,646 m^2 (about 5.5% of the city). These l areas are being revitalised in many cities in the country (e.g., Łódź, Warsaw, Gdańsk) and provide immense potential for the creation of new green areas and community-friendly services.

Implemented activities

The city implemented the project "Green backyards - pocket parks in the old districts of Wałbrzych", which involved the construction of four pocket parks. The city has a Municipal Revitalisation Programme and is planning activities under the Fair Transformation Fund: "Giving socio-economic functions to degraded, post-mining areas in the area of Beethoven Street in Wałbrzych" and "Comprehensive revitalisation of the post-mining district of Wałbrzych - Sobięcin - flagship realisation of circular economy solutions and energy-efficient construction in the Wałbrzych sub-region".

Wałbrzych Green City Action Plans actions

Actions have been proposed to increase biodiversity and green space within the city through the creation of pocket parks and the restoration of brownfield sites to serve as recreation and leisure areas or other public amenity areas. Action implementation will increase water retention, remission of greenhouse gas emissions, improve spatial qualities and thus improve the comfort and quality of life for residents. The reclamation of brownfield sites will also influence the development of new investment areas within the city.

Below is a summary of the planned actions for the Land Use sector. A detailed description of the actions can be found in **Appendix 1. Description of Wałbrzych Green City Action Plans actions**.

Table 13 Summary of actions in the Land Use sector

ID	Action	Type	Description
U1	Further development of pocket parks in the city and protection and restoration of valuable land in the city	Capital investment	Creation of pocket parks with associated infrastructure.
U2	Improving spatial order along with land protection through constant revitalization and decontamination of degraded areas	Capital investment	Change of land use and restoration of functionality of designated brownfield sites.

Action implementation

Actions include the development of a blue-green infrastructure plan, followed by the demolition of qualifying buildings and the implementation of pocket park works. The works also include the restoration of pre-existing reservoirs and the creation of a new reservoir.

As part of the revitalisation work, it is planned to regenerate Sobieski Park and to create a fund in order to buy up buildings/post-industrial sites for further work.

Financing route

The costs presented here are the sum of the expenditure of each cost category, within one sector.

Pre-investment costs:

- PLN 477,400 (EUR 102,500)

CAPEX:

- PLN 148,862,000 (EUR 31,968,100)

OPEX:

- PLN 1,278,700 (EUR 274,600)

Financing mechanisms / source:

- European Funds for Infrastructure, Climate, Environment 2021–2027
- Just Transition Fund
- Own funds of the city and the state
- Loans, credits, green bonds

Implementation barriers / challenges

- The need to resolve the ownership of brownfield sites in order to develop them, which may involve compensation payments and prolong the implementation of actions.
- Significant number of buildings (180 buildings scheduled for demolition in favour of pocket parks) and sites in need of regeneration (5.5% of the city), which implies the need to prioritise and obtain funding for their implementation.

Roles and partnerships

The entity responsible for the implementation of the actions is the Environment and Climate Department in the scope of implementation of the creation of pocket parks, in cooperation with the Revitalization and Spatial Planning Department and the Urban Planner, the Municipal Building Management, Wałbrzych Forest Inspectorate and Housing cooperatives, housing communities, private individuals and building managers.
In terms of implementation of tasks related to revitalisation, the relevant responsible entity is the Revitalization and Spatial Planning Department in cooperation with the Investment Department, Real Estate Management Department, Municipal Building Administration and Municipal Building Management.

5.1 Actions in Water and Sewage Management sector

Key conditions

Actions for this sector include the achievement of objectives:

- C9 Development, effective use and protection of the city's water resources
- C10 Improving and strengthening the functioning of the city's wastewater management

Wałbrzych does not have its own water intake and treatment plant, and due to the terrain and distance, the costs of water supply from neighbouring towns and cities are relatively high. The city experiences periods of short-lived droughts, and there is a noticeable problem of with falling groundwater which can affect water supply. The water supply in the town according to the 2021 data is 97.4%, but there are areas in poor condition that require upgrading. In terms of the sewerage network, areas have been identified with insufficient capacity. It will also be necessary to bring infrastructure to areas that are attractive for investment to enable their development and the economic development of the city. Due to climate change, the city is exposed to increasing incidences of extreme weather events, which may affect the failure rate of water and wastewater systems.

Implemented activities

The city has a "Multi-Year Plan for the Development and Modernisation of Water Supply and Sanitary Sewerage Facilities". Under the Fair Transformation Fund, the following action is planned: "Construction of a Water Treatment Plant and groundwater intake based on the intake of water flowing out of the Frederick-Wilhelm adit in Wałbrzych with a gravity system". Actions are also being taken to collect and store rainwater in specially adapted tanks. They have already been implemented at all schools in the city and at 50 public buildings. This water is mainly used for watering plants in the city. Educational campaigns are also conducted, e.g., WPWiK conducted the educational campaign "Good water from the tap" and primary school children were given water-saving booklets entitled" Adventures with Kroplinek".

Wałbrzych Green City Action Plans actions

Actions have been developed including the construction of an in-house water treatment plant for the city, which will improve water quality and increase the security of maintaining a continuous supply, which could be reduced in the event of prolonged periods of drought. In addition, the use of new treatment technology will ensure the stability of the water treatment process. The innovative technology will also save water resources and energy by reducing water and electricity losses. Actions related to the modernisation of the water supply and sewerage network as well as the expansion of the water supply system will have a positive impact on the image of the city, improve the standard of living of its residents and attract new investors. As part of infrastructure management, the implementation of an intelligent system is proposed, which will make it possible to obtain all the information needed by the relevant services, authorities or stakeholders on the efficiency and operation of the sewage and water supply network, such as flood risk assessments and identification of problems in the network.

Below is a summary of the planned actions for the Water and Sewage Management sector. A detailed description of the actions can be found in **Appendix 1. Description of Wałbrzych Green City Action Plans actions**.

Table 14 Summary of actions in the water and sewage management sector

ID	Action	Type	Description
W1	Construction of a municipal water treatment plant	Capital investment	Construction of a water treatment plant to become independent of external water suppliers from outside the city areas and a programme to purchase rainwater tanks for residents.
W2	Programme for the modernisation and renovation of the city's water and sewerage infrastructure and the construction of water supply and sewerage networks in new areas of the city	Capital investment	Implementation of a programme of modernisation and development of water and wastewater infrastructure. As part of the action, it is planned to conduct a full analysis of the technical condition of the stormwater drainage system, together with the identification of the needs and scope of investment and renovation actions.
W3	Improving and strengthening the functioning of the city's wastewater management	Enabling action	Development and implementation of an intelligent management system for water and wastewater infrastructure.

Action implementation

As part of the construction of a water treatment plant for the city, it will be necessary to develop a multi-discipline concept, prepare a design and select contractors. The programme also includes the purchase of rainwater tanks for residents.

The modernisation and renovation of the water and wastewater infrastructure will require the development of an analysis of the technical condition of the stormwater drainage system together with establishing the needs and scope of investment and renovation measures and conducting design work.

The introduction of an intelligent management system for water and sewerage infrastructure will require an inventory, monitoring and measurement campaign of the network, on the basis of which a model of the water and sewerage network will be drawn up, from which it will be possible to connect all the elements into an integrated system.

Financing route

The costs presented here are the sum of the expenditure of each cost category, within one sector.

Pre-investment costs:

- PLN 2,340,300 (EUR 502,600)

CAPEX:

- PLN 190,943,100 (EUR 41,005,000)

OPEX:

- PLN 768,700 (EUR 165,100)

Financing mechanisms / source:

- National Reconstruction Plan
- European Funds for Infrastructure, Climate, Environment 2021–2027
- Just Transition Fund
- State funds
- Loans, credits, green bonds

Roles and partnerships

The main entity implementing all actions in the water and sewage sector is Wałbrzyskie Przedsiębiorstwo Wodociągów i Kanalizacji Sp. z o.o., due to the scope of its actions covering production, treatment and supply of water along with collection, transport and treatment of sewage in the entire Wałbrzych agglomeration. The company operates a 727 km long network, five sewage treatment plants. and supplies 180,000 inhabitants and other

water consumers around Wałbrzych and surrounding locations. As part of the implementation of the actions, it will be necessary to cooperate with the city's Environment and Climate Department, which is responsible for cooperation with Wałbrzych Water and Sewerage Company in the field of collective water supply and sewage collection.

5.2 Cross – sectoral actions

Key conditions

As part of the cross-sectoral actions, it is planned to achieve the following objectives in the city:

- C2 - Implementation of strategies aimed at reducing low emissions
- C4 - Providing accessible, high-quality services, social and housing infrastructure
- C12 - Building a strong and aware local community and social activation

The sector includes actions in the field of social, educational, environmental, tourism and innovation development.

Educational actions were created in connection with the need to activate the unemployed and excluded, and to expand the qualifications of the inhabitants in the field of innovative technologies, support for entrepreneurship and local businesses. Additionally, it is necessary to cover the inhabitants with programs increasing the inhabitants' awareness of the environment, health and sustainable life.

The influx of refugees from Ukraine to the city made it necessary to intervene in the functioning of the community, create new places in nurseries and schools, as well as provide accommodation and workplaces. The actual number of refugees in Wałbrzych is probably 4-5 thousand people, which accounts for almost 5% of the city's population. It is necessary to take actions aimed at the independence of this national group, with simultaneous acceptance of the presence of these people by the inhabitants of Wałbrzych.

The analysis of health care in Wałbrzych indicates a moderate availability of medical services in the city. It is desirable to increase the number of personnel or medical facilities, or at least the contracts to increase the pool of available visits. It would be advisable to increase the availability of specialist medical services, which currently require visits to larger urban centers. Support is also needed in the continuation of health programs conducted in the city, including providing preventive and dental care to all children and adolescents living in the Wałbrzych commune by implementing a comprehensive school dentistry program.

The city analysis also found the potential to introduce smart technologies in monitoring and environmental protection.

There are two stationary air pollution measurement stations in Wałbrzych. The creation of an air quality monitoring system using drones would facilitate measurements in various places without the need to install permanent stations. Such a system could be used as an intervention to conduct measurements in places of accidents, fires, illegal waste incineration or burning in furnaces with materials other than suitable fuel.

The city also has high tourist values, there are a number of attractions and historic buildings in the city, such as: Książ Castle, Villa Daisy, Palm House, Old Mine, Porcelain Museum, which require support in development and encourage more tourists to visit. In the city, you can use the following routes: mountain hiking (76.3 km), walking (57.7 km), didactic (12.5 km) and cycling (109.4 km), which create the potential to expand and make them more attractive.

Implemented activities

In 2021, the Wałbrzych Business Incubator began to operate in the city, which is an initiative supporting the creation and development of micro and small enterprises operating in the city of Wałbrzych. As part of its activities, it offers, among others, specialized skills training as well as advisory services for people who want to start a business or develop a business idea.

The City Hall in Wałbrzych, in consultation with the Municipal Social Welfare Center, supported by people of good will, organized accommodation for Ukrainian refugees. There is an information point for refugees in the city, a special hotline and free medical care. Wałbrzych is in

the process of developing the RIRAP (Rapid Infrastructure Resilience Appraisal & Action Plan) project, aimed at, adapting city infrastructure to the challenge of accepting Ukrainian refugees by the city of Wałbrzych.

The city undertakes many programs in the field of health, such as: "Personal Assistant for a Disabled Person - edition 2021", a preventive vaccination program against human papillomaviruses (HPV) addressed to girls born in 2007 along with education on this subject, in addition, there are currently 6 dental offices in schools.

In the field of environmental protection, educational programs are carried out covering the subject of waste segregation, visits to Selective Waste Collection Points and meetings with the Mayor of the city on saving water and energy. One of the priorities of the local education policy for the school year 2022/2023 is the implementation of educational actions aimed at shaping the habits of saving water, energy, heat and waste segregation in students, which in addition to educational campaigns and training also provides for community involvement in projects organized by the commune, i.e., cleaning the city, planting ivy, participating in meetings with health and preventive health specialists. Preventive and educational programs are implemented in schools in the field of social integration, counteracting violence and support in difficult situations for people at risk of depression or addictions.

Educational campaigns are conducted in the city to raise the awareness of residents and to activate pro-ecological initiatives, such as: the annual local action entitled "Clean Wałbrzych", the "Stop Plastik" campaign, organizing ecological picnics and events entitled "Clean and green Wałbrzych", consisting in cleaning and planting trees and shrubs, meetings in the framework of "civic cafes", during which discussions are held on ecological solutions that can be implemented by residents in the protection and care of the local environment.

Wałbrzych Green City Action Plans actions

Actions were proposed to implement advanced forms of training, which influenced the development of entrepreneurship and economic diversification, improvement of professional qualifications of the inhabitants and a decrease in the unemployment level in the city.

As part of the improvement of social integration and the improvement of working and living conditions in the city for foreigners, measures were proposed consisting in the creation of the Wałbrzych Center for Foreigners Integration and the adaptation of teaching facilities to the new conditions in terms of infrastructure and teaching staff.

Increasing the efficiency of private and public care infrastructure will contribute to supporting particularly vulnerable groups in the city, improving health and social care for residents, and improving access to health care. The implementation of the action is planned by supporting health programs and creating an integrated social welfare center.

In the field of education, it is planned to implement and support existing campaigns on environmental protection, health and sustainable life, which may significantly improve the quality of life of residents by improving the environment and health of individuals.

The improvement of the quality of the environment will also be influenced by the action involving the introduction of drones as part of environmental measurements, which will help to conduct measurements on a larger scale, create intervention systems regardless of the location of the event, and improve air quality by increasing control over emitters.

The development of tourist routes and tourist attractions of the city will allow the creation of a network of connections between attractions through the implementation of a pilot program using hydrogen buses or the construction of a gondola lift, which itself may become a tourist attraction. As part of the tourist routes, it is planned to modernize them and conduct appropriate marketing actions for their promotion.

A summary of the planned cross-sectoral actions is presented below. A detailed description of the actions is provided in **Appendix 1. Description of the Green City Action Plan actions.**

Table 15 Summary cross-sectoral actions

ID	Actions	Type	Description
M1	Promoting advanced forms of training in industry and services	Enabling action	Conducting educational and information campaigns, trainings or workshops on Smart City in cooperation with local educational institutions in local workplaces and other institutions from the industry and services sector in the city.
M2	Establishment of the Wałbrzych Centre for Integration of Foreigners	Enabling action	Establishment of the Wałbrzych Center for Foreigners Integration and centers subordinate to them in individual districts of the city where Ukrainian minorities live.
M3	Adaptation of infrastructure and teaching facilities in Wałbrzych educational facilities for Ukrainian refugees	Enabling action	Providing favorable didactic and developmental conditions for children of refugees from Ukraine who study in Polish-language groups (classes), while supporting and developing education for Polish students through, inter alia, strengthening the teaching facilities, providing psychological support and adapting the scientific infrastructure.
M4	Improving the efficiency of private and public care infrastructure	Enabling action	Establishing an integrated social welfare center that will coordinate the implementation of preventive, educational and information programs for residents in cooperation with local medical institutions, e.g., mobile medical points, or campaigns in schools.
M5	Educational campaigns and awareness-raising programmes for residents	Enabling action	Implementation of campaigns, educational and information workshops, conferences and programs on environmental protection and health and sustainable life.
M6	Development of an environmental monitoring and control system using intelligent technologies	Capital investment	Purchase of drones and training and employment of employees to monitor and control the state of the natural environment in the city.
M7	Creating a network of links of tourist attractions in the city	Capital investment	Development of the network of connections of tourist attractions through the implementation of a pilot program for the creation of a bus line running between these facilities, using zero-emission hydrogen-powered buses and the creation of a feasibility study for a gondola lift. Modernization and development of existing tourist routes.

Implementation of activities

Cross-sectoral actions are characterized by different specificities, which determines the different degree of their implementation and the timetable for implementation.

In the field of promotion of advanced forms of training in the industry and services sector, it will be necessary to assess current trends and needs on the city market, determine the body responsible for conducting the campaign and develop initiatives planned in the city.

To create the Center for the Integration of Foreigners, it will be necessary to select the location, renovation and preparatory works, and to complete the staff of specialists. An analysis of the needs of creating district activity centers for the Ukrainian community is also planned.

In terms of providing infrastructure and teaching facilities, the plan is to collect and train teachers and psychologists, as well as equipping schools with accessories necessary for teachers to conduct remote learning, i.e., laptops, screens, wireless mice, keyboards, headphones.

To support the health care system, it is planned to create an Integrated Social Welfare Center, provide a staff of qualified specialists and implement preventive, educational and information campaigns.

Actions related to education and awareness-raising programs include the analysis of areas requiring education, planning the program of campaigns and educational actions in the city and their implementation.

The development of the environmental monitoring and control system will include the purchase of drones, training and employment of employees to operate them, and then the creation of a database of critical points in the city and conducting ongoing monitoring actions.

The creation of a network of connections of tourist attractions assumes the implementation of a pilot program for hydrogen buses (which involves actions in the transport sector and the provision of infrastructure for hydrogen transport), the preparation of a feasibility study for the construction of a gondola lift connecting the largest attractions in the city and the development and modernization of existing.

Financial path

The costs presented here are the sum of the expenditure of each cost category, within one sector.

Pre-investment costs:

- PLN 1,750,000 (EUR 375,800)

CAPEX:

- PLN 33,980,500 (EUR 7,297,300)

OPEX:

- PLN 13,019,100 (EUR 2,795,900)

Financing mechanisms / source:

- National Reconstruction Plan
- Just Transition Fund
- Own funds of the city and the state

Significant barriers and challenges in the implementation of actions

- The need to adapt the infrastructure to hydrogen buses.
- Implementation and training of staff in the field of modern technologies, i.e., operation of drones for air measurements.
- Possible conflicts between the Polish and Ukrainian communities because of cultural and political differences.

Roles and partnerships

Educational actions are the responsibility of the Education and Social Affairs Department in cooperation with educational and training institutions. In terms of entrepreneurship education, cooperation with InWałbrzych Sp. z o.o., Wałbrzych Special Economic Zone "INVEST-PARK" Sp. z o.o. and the Poviat Employment Office in Wałbrzych. In terms of ecological education, cooperation should be undertaken with the Environment and Climate Department, Municipal Buildings Management and Municipal Utilities Company as a continuation of actions already in progress. In the field of activities related to society, health and migrants, the Education and Social Affairs Department will be responsible for the implementation of actions together with the support of the Municipal Social Welfare Centre in Wałbrzych, and health clinics in Wałbrzych. The Environment and Climate Department will be responsible for the introduction of intelligent technologies in the system of monitoring and control of the natural environment, with cooperation with the Municipal Police, the Municipal Social Assistance Centre in Wałbrzych, and the Provincial Inspectorate for Environmental Protection in Wrocław – Office in Wałbrzych. For the development of tourism and the introduction of actions aimed at its promotion and network of connections will be the City Promotion Department together with the Education and Social Affairs Department, the Road, Communication and City Maintenance Authority in Wałbrzych, the Transport and Road Traffic Department, the Department of Revitalization and Spatial Planning, as well as the Local Tourist Organization of the Wałbrzych Agglomeration.

Summary of developed actions

Table 16 Summary of actions developed in the Wałbrzych Green City Action Plan

Sector	Number of capital investments	Number of actions in the sector	Total estimated capital cost (EUR)*	Job creation potential	Total estimated reduction of CO_2 (tCO_2/year)	Total estimated savings (EUR/year)
Energy	3	3	108,901,400	65 – 95	77,941.41	5,974,923
Buildings	3	3	165,042,500	31 – 50	20,037.07	786,679
Transport	5	5	40,896,800	56 – 85	2,475.00	-
Waste	2	3	52,503,200	80 – 130	-	-
Land use	2	2	32,070,600	16 – 30	44.93	-
Water and Sewage Management	2	3	41,507,600	3 – 17	-	-
Cross – sectoral	2	7	7,673,100	574 - 1117	-	-
Sum	**20**	**26**	**448,595,200**	**825 - 1524**	**100,498.41**	**6,761,602**

* The total estimated capital cost shown is the sum of pre-investment costs and capital expenditure.

6. Monitoring and reporting

Source: City Hall of Wałbrzych

6. Monitoring and reporting

6.1 Monitoring implementation and results

The monitoring process will include two components:

- **Monitoring the implementation progress,** reviewing the progress of the implementation of actions developed under the Wałbrzych Green City Action Plan.
- **Monitoring the results,** checking whether the implemented actions and undertaken implementation steps bring the expected positive changes in the city and whether they will translate into the achievement of the vision and objectives of the document.

The Budget Department of the City Hall in Wałbrzych will be responsible for the process of monitoring and preparing evaluation reports.

Components of implementation progress monitoring

To ensure consistency and cooperation, the four main components that determine the effectiveness of the process are presented below.

Table 17 Components of the monitoring progress

Reporting and monitoring framework	The unit responsible for the monitoring process will define the reporting framework and will supervise the implementation of the Green City Action Plan. This will mainly include actions taken by other offices and entities identified as responsible for the action and cooperation with stakeholders.
The responsibilities of coordinating entities and cooperating stakeholders	In Appendix 1. entities responsible for a given action are specified. These units will be responsible for coordinating the work with stakeholders cooperating in the implementation of actions in accordance with the schedule and supervising their implementation.
Financing of actions	Entities responsible for actions in cooperation with the city Treasurer and Budget Department will obtain a budget for actions, both from external and internal funds. In order to optimize this process, Appendix 1. Provides estimates of pre-investment costs, capital expenditure and operating costs, and identifies possible sources of funding for the actions.
Review and evaluation	The entities responsible for the implementation of the actions will collect data on the progress in their application. The collected information will be regularly (at least once a year) forwarded to the Budget Department of the City Hall. This unit, together with the entities responsible for a given action, will be able to adjust the period and steps for the implementation of the action to enable an efficient process.

Components of results monitoring

A crucial element of the monitoring will be the ongoing observation of the results of actions implemented in the city. This will allow for an objective look at the results of the implementation of the Green City Action Plan and possibly to verify the original assumptions, if the observed progress is unsatisfactory. The action tables in Appendix 1 define the action implementation indicators, which will enable measurable determination of the progress of the developed actions. As a tool supporting the monitoring process, it is recommended to use the database of indicators created under the project, containing assessments of pressure-state-response indicators, used to analyze the condition of the existing city. Data for indicators related to a given action should be collected and updated on a regular basis. The unit responsible for the monitoring process will supervise the process of collecting data in this regard and cooperation with entities responsible for the actions in the field of results monitoring. The actions of the units responsible for a given action will include: tracking contacts with stakeholders, collecting and reviewing data and providing information that includes an actual assessment of the impact of actions, resources and budget on their implementation. This information should be regularly provided to the unit responsible for monitoring in accordance with the agreed reporting periods. It is recommended that the method and indicators of results monitoring should be reviewed annually and corrected if necessary.

The framework of the monitoring and evaluation process of the assumptions of the Wałbrzych Green City Action Plan is presented below

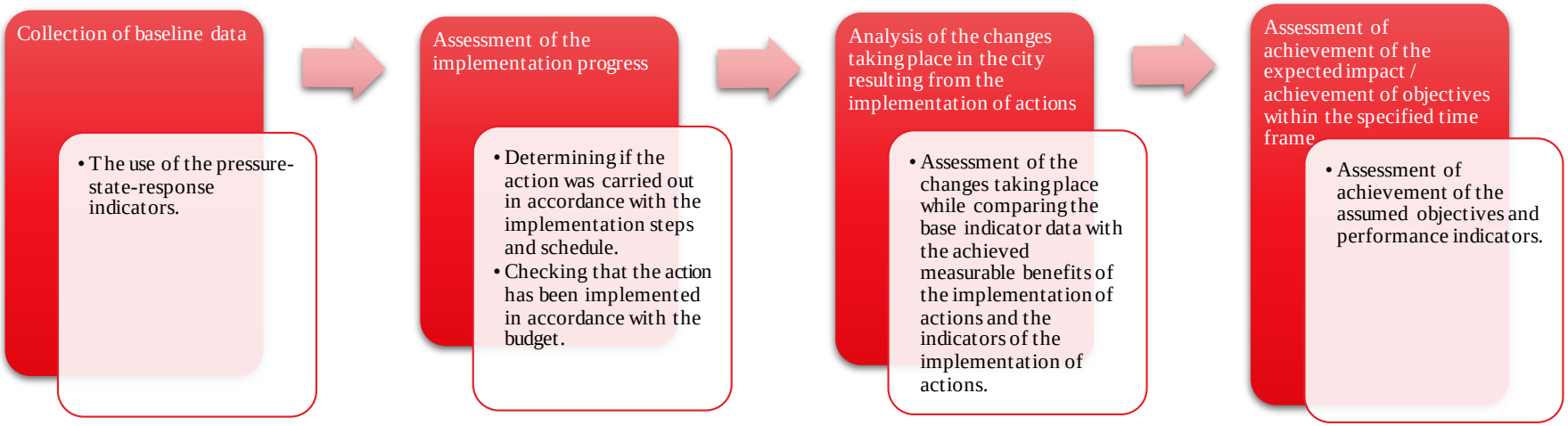


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Figure 11 Diagram of the monitoring and evaluation framework

Appendix 1.

Description of Wałbrzych Green City Action Plan actions

Source: City Hall of Wałbrzych

Appendix 1. Description of Wałbrzych Green City Action Plan actions

Sectors

Icon	Sector
	Energy
	Buildings
	Transport
	Land use
	Water and sewage management
	Waste
	Cross-sectoral

SECTOR: ENERGY

Action E1
Construction of PV farms in the city

Action E2
Development of local heat sources based on RES. Intensification of the use of green energy

Action E3
Modernization of the distribution network

E1 Construction of PV farms in the city

Timescale	Sector	Type of action	Objectives/ priorities
2025-2027		Capital investment	C1 – Striving for decarbonization and achieving climate neutrality

Description and scale of action

Development of installations for renewable energy sources, consisting of:

1. Construction of photovoltaic farms in 3 locations with a total capacity of about 21 MW. The construction of photovoltaic farms will be possible in three areas indicated by the city:
    - Plot A - Plot 64/33 with an area of 3.37 ha,
    - Plot B - Plot 93/41 with an area of 3.92 ha,
    - Plot C - The area in the complex of plots between Orkana and Uczniowska streets with an area of 24.5 ha.
2. Installation of photovoltaic panels on the roofs of public buildings with a total capacity of approximately 124 kWh. The installation of photovoltaic panels will include buildings such as: Castellan Library, Public Primary School No. 37, Municipal Social Welfare Center, buildings located at Rusinowa Street, buildings located at Kopernika Street.

A constraint on the development of technologies that enable the generation of electricity from renewable sources across the city is the lack of capacity of the existing electricity grid. In order to make this development possible, it is necessary to simultaneously implement the investments presented in the next dedicated action E3 to increase the capacity of the city's electricity grid.

In addition, there are action plans to develop an interdisciplinary feasibility study for a hybrid surplus energy storage system for pumped storage power plant in the Kopernik Shaft area. The existing shaft infrastructure is in an area where an investment in the construction of a pumped storage power station could be realised. Pumped storage technology involves the conversion of electricity into potential gravity energy by pumping water from the lower reservoir to the upper reservoir during periods of excess production over electricity demand (e.g., at night) and then, during peak hours, the process is reversed.

It is also important to ensure that electricity can be stored on-site (energy storage - lithium-ion batteries) or used immediately. Installing photovoltaic panels on buildings located in the city's oldest districts (Podgórze, Nowe Miasto, Śródmieście, Stary Zdrój) would help to provide an alternative source of power for residents and would be the most effective solution in terms of reducing CO_2 emissions (combined with the replacement of low-efficiency heat sources in residential buildings). The action provides creation of energy storage facilities with a total capacity of 7.4 MW and a generation of approximately 30 MWh.

A potential and disruptive technology that could be implemented in the future through the development of solar power generation sources within the city, could be the use of electrolysers to produce green hydrogen. The high-pressure technology for hydrogen production operates at low voltage, allowing integration with photovoltaic installations.

Background and justification of action	In the last two years, photovoltaics has become the main renewable energy source in Poland. Installed capacity in photovoltaics in 2020 and 2021 achieved spectacular results. According to data from the Energy Market Agency, installed photovoltaic capacity at the end of 2021 was 7.67 GW and reached 9.4 GW at the end of the first quarter of 2022. Photovoltaic installed capacity almost doubled during 2021 compared to the previous year. This proves the relative simplicity of this solution as well as the greatest economic efficiency of these undertakings. The city does not have its own sources of electricity and is powered from the nationwide electricity grid. The distribution network in the city is served by a distribution company serving the south-west of Poland. A major limitation in the development and construction of new photovoltaic farms across the country is the lack of capacity of the existing distribution network. This results in holding up the process of obtaining conditions by investors for the connection of new RES generation sources to the grid. In Wałbrzych, the Strategy for the development of the energy cluster is currently being prepared, along with the preparation of an energy balance. The city is also considering the installation of hydrogen production plant and using renewable energy from biogas.
Schedule	**Action implementation steps** / **2023** / **2024** / **2025** / **2026** / **2027** / **2028** / **2029** / **2030** Development of an interdisciplinary feasibility study for a hybrid storage system for surplus energy in a pumped storage power plant in the Copernicus shaft area Construction of energy storage (lithium-ion batteries) Construction of PV farms Installation of photovoltaic panels/systems
Action owner	Environment and Climate Department
Main stakeholders	Tauron Dystrybucja S.A. – Office in Wałbrzych Municipal Utility Company Sp. z o.o. InWałbrzych Sp. z o.o. Wałbrzych Energy Cluster Private investors
Action benefits	• Reduction of greenhouse gas emissions at the level of 14,518 tCO_2/year Methodology: The annual production of photovoltaic installations was estimated at 20,800 MWh. Emission reductions were determined by assuming an electricity emissivity of 0.70 tCO_2/MWh.
Enabling policies,	• Low-Emission Economy Plan for 2014-2020 with perspective to 2030 for 15 municipalities of the Wałbrzych Agglomeration

strategies and actions	• Study of the city's spatial conditions and directions • Municipal Climate Change Adaptation Plan for Wałbrzych Local Development Program • Wałbrzych Energy Cluster Program • Related to the planned action reported under the Just Transition Fund: "Construction of infrastructure for the production and storage of energy from solar radiation and biogas in the area of the Wałbrzych Energy Cluster and partner communes". • Related to urbanistic objectives of Territorial Just Transition Plan: "Support for investments in alternative energy sources (also PV installations and heat pumps) and energy efficiency. Support will be available also for prosumers for RES installations and energy storage facilities".
Result indicators	• Achieve a share of electricity generation from RES of at least 20 MWh.
Potential to develop inclusivity and improve social aspects	• Generation of new employment opportunities. Ensuring the inclusiveness of the recruitment process and equal access for women to green jobs.
Potential for the implementation of innovative and smart technologies	• Possibility to use digital tools for controlling stored electricity and optimal management of generated electricity from renewable sources. • Possibility of implementing farms/installations of photovoltaic panels with energy storages • Using innovative electrolysers to produce green hydrogen. • To optimize the efficiency of photovoltaic (PV) systems a sensor architecture can be equipped with voltage, current, irradiance, temperature, and inertia sensors for monitoring (at panel level) of a PV system. These sensors can use a wireless communication system such as LoraWan. Within these sensors the detection of critical faults (temporary and permanent shadowing, dirtying, and anomalous aging) can be addressed to shorten ROI of the investment.
Mapping of risks, challenges	• Increase in average annual air temperature and the occurrence of hot days - extreme climatic conditions and the identified risk of temperature rise in the city determines the need and favor the introduction of local energy sources based on renewable energy sources, such as solar and photovoltaic installations. • The challenge of grid failure and energy losses caused by damage due to extreme climatic events can be minimized by building your own energy storage facilities.

	Pre-investment	**Capital expenditure**	**OPEX**
Costs	PLN 21,802,000 EUR 4,682,000	PLN 173,560,000 EUR 37,272,000	PLN 2,478,000 EUR 532,000

	Potential forms of savings
	PLN 27,822,000 EUR 5,975,000 • The estimated savings represent the avoided cost of purchasing electricity over the period 2025-2030. The estimated annual production of photovoltaic installations will be approximately 20,800 MWh. The unit price of the avoided cost of electricity purchase including distribution is 1.34 PLN/kWh.
Cost calculation	Data source: Projects implemented by Arup, Wałbrzych City Hall, Fraunhofer Institute for Solar Energy Systems ISE, Photovoltaic Market in Poland report in 2022, BloombergNEF, CIRE, Columbus Energy, Photovoltaic Geographical Information System – European Commission.
	Data from 2005 to 2020 has been analyzed to determine the value of the maximum daily electricity production from 1 kW of photovoltaic installation. It was determined that for the city of Wałbrzych, the highest daily value of electricity production is 1,397 kWh (20.04.2022). Battery power was determined for this value, assuming a 4-hour capacity. Pre-investment costs (18% of capital expenditures related to the implementation of investments in a photovoltaic) are related to: • Rights to the project (if any), • Any type of consideration paid to obtain design and / or acceptance contracts, • Compliance with the rules for the use of funds from the support policy, • Permits necessary for development, construction and operation, • Environmental regulations, • Geological surveys or structural analyzes, • Payment of geodesist, • Development of a conceptual and detailed design, • Preparation of the necessary other documentation, • Financial costs necessary for the development and construction of a PV system, such as construction financing costs. 1. Plot A – PLN 1,118,000 (EUR 240,00) 2. Plot B – PLN 1,301,000 (EUR 279,000) 3. Plot C – PLN 8,132,000 (EUR 1,746,000) The pre-investment costs associated with the development of an interdisciplinary feasibility study for a hybrid storage system for surplus energy in a pumped storage power station in the Kopernik Shaft area were estimated at PLN 500,000 (EUR 107,000).

The capital expenditure related to the comprehensive construction of a PV farm is PLN 2.7 million per 1 MW. It is assumed that 1.5 ha of the area should be allocated to the solar installation with a production capacity of 1 MW.

- Plot A – 2.25 MW – PLN 6,066,000 (EUR 1,302,000)
- Plot B – 2.6 MW – PLN 7,056,000 (EUR 1,515,300)
- Plot C – 16.3 MW – PLN 44,100,000 (EUR 9,470,000)

The capital expenditure related to the construction of energy storage ranges from PLN 7.727 million to PLN 7.979 million per 1 MW of power.

- Plot A – energy storage with an estimated capacity of 0.78 MW and a generation of 3.14 MWh. – PLN 6,106,000 (EUR 1,311,000)
- Plot B – energy storage with an estimated capacity of 0.91 MW and a generation of 3.65 MWh. – PLN 7,103,000 (EUR 1,525,000)
- Plot C – energy storage with an estimated capacity of 5.71 MW and a generation of 22.82 MWh. – PLN 44,394,000 (EUR 9,533,000).

The capital expenditure related to the installation and assembly of photovoltaic micro-installations depends on the size of the installation. The cost distribution is as follows:

- Construction of a photovoltaic micro-installation with a total power of about 5 kW - the average cost is PLN 4.8 thousand per 1 kW.

- Construction of a photovoltaic micro-installation with a total power of about 10 kW – the average cost is PLN 4.15 thousand per 1 kW.

- Construction of a photovoltaic micro-installation with a total power of about 50 kW – the average cost is PLN 3.29 thousand per 1 kW.

On the roofs of the indicated buildings, you can install photovoltaic panels with an estimated power:

- Castellan Library – 10.8 kW – PLN 44,820 (EUR 9,625)
- Public Primary School No. 37 – 48 kW - PLN 157,920 (EUR 33,913)
- Municipal Social Welfare Centre – 36 kW - PLN 118,440 (EUR 25,435)
- Buildings located at Rusinowa Street – 24 kW - PLN 78,960 (EUR 16,957)
- Buildings located at Kopernika Street – 7.2 kW - PLN 34,560 (EUR 7,422)

The operating costs of maintaining a photovoltaic panel farm are related to the costs of cleaning modules and vegetation management, system control and monitoring, replacement of components, replacement of damaged modules, replacement of damaged inverters and administration. These costs range from PLN 36.3 thousand per 1 MW to PLN 67.5 per 1 MW thousand per year.

- Plot A PLN 116,649 (EUR 25,050)
- Plot B PLN 135,686 (EUR 29,139)
- Plot C PLN 848,040 (EUR 182,117)

	The total operating costs of all included elements amount to PLN 2,478,700 (EUR 532,300).
Financing mechanisms / source	1. *National Reconstruction Plan* • B2.2.2 Renewable energy investments carried out by energy communities (including local government units), subsidies • B2.4.1. Energy storage systems, loans • B3.4.1. Investments for comprehensive green transformation of cities, subsidies 2. *Program European Funds for Infrastructure, Climate and Environment 2021–2027* • Objective 2.2. Promotion of renewable energy o CODE 48. Solar renewable energy, o CODE 53. Smart energy systems and related storage, 3. Just Transition Fund • investments in the deployment of technologies and systems and infrastructure for affordable clean energy, energy storage, reduction of greenhouse gas emissions, development of RES and improvement of energy efficiency, including for the purpose of reducing energy poverty, 4. *Own funds of enterprises investing in RES in the ESCO or public-private partnership formula,* 5. *NFOŚiGW, Energy Plus Program, preferential loans,* 6. *Loans, credits, green bonds,* 7. *The city's own funds.*
Impact on the implementation of the sustainable development goals	

E2 - Development of local heat sources based on RES. Intensification of the use of green energy			
Timescale	**Sector**	**Type of action**	**Objectives/ priorities**
2023 - 2028		Capital investment	C1 – Striving for decarbonization and achieving climate neutrality
Description and scale of action	A necessary action for implementation at the current stage of the city's development is to develop an update of the "Plan for the supply of heat, electricity and gas fuels of the city of Wałbrzych." The district heating system does not even cover 50% of the city's heating needs. Heat is mainly supplied to areas where multi-family housing and public buildings are concentrated, in the northern districts of the city. Unfortunately, the topography and terrain (hilly areas) do not allow for significant development of district heating from central sources within the city. However, there is a possibility of building island heating systems that would supply heat to a group of consumers located in the southern parts of the city. An innovative and necessary solution to improve the efficiency and increase the accessibility of the heating system in Wałbrzych will be the implementation of a pilot program for the installation of a low-temperature 5th generation heating network. It is assumed that the plan is to build a new and adapted network with a length of 750 m, in a selected area of the city, with a potential for heat demand of 3 MW and for cooling of 2 MW. Potential sources could be: waste heat, heat pumps and in future, energy from heat and cold storage facilities. The identification of specific and most rational sources of power will be possible after more detailed analyses. Thermal Energy Company in Wałbrzych (PEC) manages 2 heating plants in the city. The C-3 heating plant with a total boiler power of 69 MW is powered by solid fuel in the form of coal fines. The second C-1 heating plant is powered by natural gas and has a capacity of 15.2 MW. The planned modernization of power sources aims to completely move away from coal as a fuel used to produce thermal energy. The basis of this project is the installation of two biomass boilers of 8 MW capacity each, together with heat recovery from the fuel gases using heat pumps with a capacity of 2 MW for each boiler and a heat accumulator with a capacity of about 2.3 thousand m^3. The second element of the system is the section of 6 air heat pumps. The total capacity of this section is estimated at about 4.85 MW. The electricity demand of this system will be supplied from the cogeneration system and photovoltaic systems. Temporarily, the CHP will be based on 4 gas engines, the power source of which will only be a transitional fuel in the transformation of the heat network supply. This is due to the fact that no other alternative energy source is currently economically viable. In addition, the system will be supported by energy recovery heat pumps. Energy to power, the heat pumps will be temporarily supplied from gas cogeneration and an extensive photovoltaic installation (additional 1 MW). Additionally, in order to increase the efficiency of existing district heating networks (39.5 km), it is proposed to make investments related to the replacement of district heating network insulation along with the replacement of overhead networks with networks in the technology of pre-insulated duct pipes. Currently, 6% of the existing district heating network is an inefficient overhead network.		

Background and justification of action	Approximately 5.4 million of Polish households (translating into 40% of all households) are supplied by district heating system, making Poland one of the largest markets in Europe for district heating. Heat supply technologies have been evolving since the end of the nineteenth century, when water vapor with temperatures above 150°C began to be used as a heat carrier. Subsequently, hot water with a temperature above 130°C was used as a heat carrier, sent through steel pipes without insulation running in concrete channels. The third generation of district heating systems caused the water temperature to be lowered below 100°C and pre-insulated pipes were dug into the ground. In the fourth generation (partially used today), the water temperature in the network drops below 70 ° C and the integration of urban heating, energy, sewage and gas infrastructure into one system begins. Currently, work is underway on the fifth generation of the heating system, in which it is assumed that the water temperature in the network will be between 28-50°C and will use waste heat, heat and cold stores, and renewable energy installations. This will enable the integration of prosumers, energy storage, heat pumps, PV farms, cogeneration and geothermal installations. The innovation of this solution involves the modernization of the existing infrastructure and the construction of energy storage and IT systems to regulate the operation of many energy sources. Heat and cool should be provided, i.e., from buildings with a positive energy potential (surplus heat and cool produced e.g., in homes and offices). This system will be able to adapt to a specific recipient and the individual needs. The investment concept is currently being prepared in the city as part of the program "Decarbonisation of buildings and municipal infrastructure in the municipalities of the Wałbrzych Agglomeration" for the development of energy audits and the "Warm apartment" program, consisting of replacement of heat sources and thermal modernization based on, inter alia, or heat pumps.
Schedule	**Action implementation steps** / 2023 / 2024 / 2025 / 2026 / 2027 / 2028 / 2029 / 2030 Development of the "Plan for heat, electricity and gas fuel supply for the city of Wałbrzych" A pilot program for the implementation of a low-temperature heating network Changing the power source of the heat plant in the city to biogas boilers, heat pumps and a cogeneration system Replacing the insulation of heating network pipes along with the replacement of overhead networks for heating networks in the technology of channel pipes
Action owner	Thermal Energy Company in Wałbrzych
Main stakeholders	Municipal Building Management Municipal Utility Company Housing cooperatives: Poniatów, Skarbek

Action benefits	• Reduction of greenhouse gas emissions at the level of 63,336 tCO_2 Methodology: The described modernisation of the district heating plant will result in emission savings of 63,000 tCO_2 per year. A loss reduction of 1,013 MWh per year has been identified for the upgrading of district heating networks. A heat emission factor of 0.332 tCO_2/MWh was assumed.
Enabling policies, strategies and actions	• Assumptions for the heat, electricity and gas fuel supply plan for the Wałbrzych Commune (2019) • Low-Emission Economy Plan for 2014-2020 with perspective to 2030 for 15 municipalities of the Wałbrzych Agglomeration • Related to the planned action submitted under the Just Transition Fund: "Construction of infrastructure for the production and storage of energy from solar radiation and biogas in the area of the Wałbrzych Energy Cluster and partner communes". • Related to economic objectives of Territorial Just Transition Plan: "Investments in the infrastructure of district heating companies, including district heating networks leading to a change of energy and heat sources to RES, as well a as reduction of GHG emissions".
Result indicators	• Change of PEC heat supply sources from coal sources to alternative sources – biomass boiler rooms, heat pumps, gas cogeneration with a total capacity of 45 MW. • The length of the replaced insulation of the district heating network together with the replacement of overhead networks with networks in the technology of duct pipes [km].
Potential to develop gender equality and social inclusion	• Providing households suffering from energy poverty and vulnerable groups with priority access to the program enabling them to connect to the heating system. • Ensuring a balanced participation of all genders in the process of the development of an update of the heat, electricity and gas fuel supply plan for the city of Wałbrzych. • Developing a program of energy advisers who would provide information on energy spending and saving patterns, which will be available to households suffering from energy poverty and vulnerable groups.
Potential for the implementation of innovative and smart technologies	• Creation of a thermal energy management system to best design and integrate various RES resources. The digital transformation of the heat supply network will be necessary in order to enable the integration of multiple decentralized heat sources based on RES. • To design a smart district heat system with *smart control system*, which could constantly monitor, control and manage the whole heating system to ensure high effectiveness and reliability. Using solutions such as: an accurate/complete GIS mapping of the network, SCADA (Supervisory Control And Data Acquisition), flow, temperature sensors and pressure sensors at pumping station.

	• Piloting the implementation of a smart heat meter before final implementation. Smart heat metering at building/appartment level are going to be necessary to enable BEMS (Building and Energy Management System). • In a more advance stage, enabling the development of smart systems supporting the growth of energy management maturity in the city, such as: BEMS (Building and Energy Management System), HEMS (Home Energy Management System).
Mapping of risks, challenges	• In Wałbrzych, the phenomena of frosty days (there are about 115 days with a minimum temperature <0°C per year) and cold waves are recorded (On average there are 2 periods of at least 3 days per year with temperatures below -10°C). The burning of solid fossil fuels for heating emits copious amounts of pollutants into the air. Limiting the combustion of fossil fuels for heating purposes and limiting the failure of infrastructure (by replacing the insulation of the heating network along with the replacement of overhead networks with networks in the technology of duct pipes, pre-insulated) will counteract the risk of failures and interruptions in heat supply, as well as increase the efficiency of these systems.
Costs	**Pre-investment** / **Capital expenditure** / **OPEX** PLN 50,000 / PLN 173,203,000 / PLN 65,800 EUR 10,700 / EUR 37,195,000 / EUR 14,120 **Potential forms of savings** • The modernisation of the CHP plant will avoid the cost of purchasing the coal, gas and electricity needed to operate the current CHP plants. • Modernising the district heating network will reduce heat transmission losses, which will also reduce the cost of heat generation.
Cost calculation	Data source: Projects implemented by Arup, Municipal Office in Wałbrzych, Przedsiębiorstwo Energetyki Cieplnej S.A. in Wałbrzych, Szczecińska Energetyka Cieplna, RewardHeat, European Funds (Cohesion Fund) – Infrastructure and Environment, Zakład Energetyki Cieplnej MZK Sp. z o.o. in Stalowa Wola. Pre-investment costs are an expense related to the development of an update of the "Plan for the supply of heat, electricity and gaseous fuels of the city of Wałbrzych" PLN 50,000 (EUR 10,700). Capital expenditures related to the implementation of a pilot project for the development of a low-temperature 5th generation heating network in the area selected by the city estimates around PLN 88,127,000 (EUR 18,925,000). In addition, as part of the action, the power sources of the existing municipal heating plant should be modernized in order to completely move away from coal (preliminary assumptions and cost estimates of the planned investment have been made available by Thermal Energy Company in Wałbrzych). PLN 80,000,000 (EUR 17,180,000). In order to maximize the potential of the existing heating network infrastructure in the city, measures should be taken to increase energy efficiency by modernizing the

	remaining 6% of the overhead heating network (2,370 m), by creating a pre-insulated canal network. The cost of such an undertaking range from PLN 1,985 to PLN 2,299 per meter. In total, it is estimated that this expenditure will amount to PLN 5,076,000 (EUR 1,090,000). The operating costs represent expenditure related to repair and maintenance services of the heat infrastructure (e.g., automation of equipment operation, increased durability of equipment, reduced operating losses, increased reliability of power supply to consumers), and were estimated on the basis of data made available by Przedsiębiorstwo Energetyki Cieplnej S.A. in Wałbrzych. The operating costs will amount to an approximate PLN 65,800 (EUR 14,120).
Financing mechanisms / source	1. *National Reconstruction Plan* • B1.1.1. Investments in heat sources in heating systems, subsidies • B2.2.1. Development of transmission networks, smart electricity infrastructure, subsidies • B2.2.2 Renewable energy investments carried out by energy communities (including local government units), subsidies • B3.4.1. Investments for comprehensive green transformation of cities, subsidies 2. *Program European Funds for Infrastructure, Climate and Environment 2021–2027* • Objective 2.2. Promotion of renewable energy o CODE 48. Solar renewable energy, o CODE 49. Renewable energy biomass, o CODE 50. Renewable energy biomass with high level of greenhouse gas reduction, o CODE 52. Other RES (including geothermal), o CODE 53. Smart energy systems and related storage, o CODE 54 - High-efficiency cogeneration, heating and cooling system, o CODE 55 - High-efficiency cogeneration, an efficient heating and cooling system with low emissions over the life cycle. 3. Just Transition Fund • renovation and modernisation of district heating networks and investment in heat generation (installations based solely on RES), 4. *Own funds of enterprises investing in RES in the ESCO or public-private partnership formula,* 5. *NFOŚiGW, Energy Plus Program, preferential loans,* 6. *Loans, credits, green bonds,* 7. *The city's own funds.*
Impact on the implementation of the sustainable development goals	

E3 - Modernization of the distribution network			
Timescale	**Sector**	**Type of action**	**Objectives/ priorities**
2025-2030		Capital investment	C1 – Striving for decarbonization and achieving climate neutrality
Description and scale of action	Modernization of the existing power grid in order to increase its efficiency and capacity as well as the ability to connect new RES capacities. It is estimated that for the needs of the Wałbrzych Special Economic Zone itself, the current capacity of the existing power grid should be increased by a minimum of 40 MW. It should be mentioned that further investment areas are being purchased, where new projects are planned, which in the future will generate additional demand for connection to the power grid (potentially, another additional 40 MW). The subject of such a project should be the modernization of low and medium voltage lines consisting in the replacement of wires and cables. Existing uninsulated overhead line conductors should be replaced with new insulated type conductors with increased cross-section. Thanks to this, the capacity of the power grid and the ability to connect new RES capacities will be increased. The proper functioning of the power grid should also be ensured, enabling the connection of RES units in dispersion. Parts of the accompanying infrastructure, such as poles, overhead connections or cable connections, should also be replaced. The action also foresees the development of a system/database - or app for tracking energy consumption and cost-effective planning of household energy use, which will enable users to monitor their energy consumption and assess how they can use energy more efficiently. This tool will allow electricity consumers to join the energy transition as informed participants (including by enabling discounts at times of peak renewable electricity generation, allowing households to reduce their individual carbon footprint). Moreover, in order to increase the capacity and stability of the power grid, it is recommended to build a substation with transformers with a minimum real power consumption of 40 MVA. An important aspect is that without this investment it will not be possible to implement actions related to the generation of energy from RES.		
Background and justification of action	The supply of electricity to consumers located within the city of Wałbrzych is conducted via Central Supply Points (110 kV/SN substations) connected to 110 kV overhead HV lines. From these stations, medium-voltage lines are brought out to supply power around the city, including: MV/nn transformer stations, MV cable connectors and one 20 kV network switchgear. The technical condition of the existing power grids is assessed as sufficient, but the extensive scale of the projects and the extremely excessive cost associated with replacing cables in dense housing is a significant constraint for the city to undertake such large investments on its own.		

Schedule	**Action implementation steps**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
	Development of a system/database - or application - for tracking energy consumption and cost-effective planning of domestic energy use								
	Modernization of the existing power grid at the indicated place								
	Implementation of the construction of a new substation								
Action owner	Tauron Dystrybucja S.A. – Office in Wałbrzych								
Main stakeholders	Wałbrzych Special Economic Zone "INVEST-PARK" InVałbrzych Sp. z o.o.								
Action benefits	• Increase network capacity by a minimum of 40 MW.								
Enabling policies, strategies and actions	• Low-Emission Economy Plan for 2014-2020 with perspective to 2030 for 15 municipalities of the Wałbrzych Agglomeration								
Result indicators	• Length of modernized low and medium voltage lines, consisting in the replacement of wires and cables [km]. • The amount of the accompanying infrastructure replaced, including poles, overhead connections or cable connections [pcs.].								
Potential to develop inclusivity and improve social aspects	• Generation of new employment opportunities. Ensuring the inclusiveness of the recruitment process and equal access for women to green jobs.								
Potential for the implementation of innovative and smart technologies	• Deployment of appartment smart heat meters. • Creation of an application for tracking energy consumption and economic planning of home energy use. • To create a digital model of the eletric transmission lines, including the sensors which will be installed to monitoring outages or hazards. This action would constitute a key building block to develop a digital twin of electricity infrastructure in the city. • The implementation of a smart grid management system. It is necessary to enable the integration of greater share of RES, especially solar and wind and distributed energy systems. This will be able to safely and reliably transmit electricity to customers in case of any external or internal failure or danger. A quick self-healing capability will allow the system to dynamically reconfigure itself to survive attacks, natural disasters, outages or network component failures. Additionally, this reduces technical losses.								

<table>
<tr><td>Mapping of risks, challenges</td><td>

Occurrence of heat waves and cold - an extended period with extreme temperatures can cause interruptions in the supply of traction energy due to overloading of power grids or the occurrence of icing and grid failures,
Occurrence of intense winds and storms creates the possibility of damage to the power network and disruptions in the operation of devices caused by lightning strikes or fallen objects/trees, and the modernization towards cable networks with lower failure rate and susceptibility to weather conditions may minimize this risk.

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<tr><td rowspan="3">Costs</td><td>
<table>
<tr><th>Pre-investment</th><th>Capital expenditure</th><th>OPEX</th></tr>
<tr><td>PLN 9,031,000
EUR 1,938,000</td><td>PLN 129,462,000
EUR 27,781,000</td><td>PLN 5,000,000
EUR 1,073,800</td></tr>
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<tr><td>Potential forms of savings</td></tr>
<tr><td>

Upgrading the currently inefficient electricity grid will avoid costs associated with repairs and electricity transmission losses.
The implementation and deployment of an energy tracking application for households and public entities will optimise energy consumption, resulting in lower final electricity bills.

</td></tr>
<tr><td>Cost calculation</td><td>Data source: Wałbrzych City Hall, EU subsidy map, Energa Operator, Community Research and Development Information Service (CORDIS) of the EU, TAURON Dystrybucja S.A., Projects implemented by Arup.

Pre-investment costs represent the expense of developing a system/database - or application - for tracking energy consumption and cost-effective planning of domestic energy use - PLN 9,031,000 (EUR 1,938,000).

The capital expenditure will be related to the construction and modernization of the MV and LV power grid, enabling the connection of RES electricity generation units in the Wałbrzych Special Economic Zone. The capacity of the electricity network will be increased by an additional 40 MW - PLN 29,462,000 (EUR 6,327,000).

In addition, it is recommended to build a new indoor main electric power point with a capacity of 40 MVA along with the accompanying infrastructure (building), which includes a line, measurement and transformer field with circuit breakers and the necessary devices, switching stations with two transformers (one adapted to the basic connections, the other to the backup connections) 40 MVA and the supervision and control system - PLN 100,000,000 (EUR 21,475,000).

The estimated operating expenditure of the substation operation (staff salaries, maintenance, repairs and servicing) is estimated to be around 5% of capital expenditure per year. The estimated cost is PLN 5,000,000 (EUR 1,073,800).</td></tr>
<tr><td>Financing mechanisms / source</td><td>1. National Recovery Plan

B2.2.1. Development of transmission networks, smart electricity infrastructure, subsidies
B3.4.1. Investments for a comprehensive green transformation of cities, grants

</td></tr>
</table>

	2. *European Funds programme for Infrastructure, Climate, Environment 2021–2027* • Objective 2.2. Supporting renewable energy o CODE 53. Smart energy systems and related storage, 3. *NFOŚiGW, Energy Plus Programme, preferential loans,* 4. *Loans, credits, green bonds,* 5. *Own resources of the city.*
Impact on the implementation of the sustainable development goals	

SECTOR: BUILDINGS

Action B1 Further modernization of the district heating system

Action B3 Tackling energy poverty

Action B2 Creating a program of deep thermal modernization and revitalization of municipal buildings in the city

B1 Further modernization of the district heating system

Timescale	Sector	Type of action	Objectives/ priorities
2023-2028		Capital investment	C2 - Implementing strategies aimed at reducing emissions from low emitors

Description and scale of action	The action includes the creation of a special fund to continue the realisation of the programme "Replacement of high-emission heat sources in buildings and residential premises in selected communes of the Wałbrzych Agglomeration". This program had a fund in the amount of PLN 24,212,601.37 and was intended to provide grants to residents that were to liquidate at least 637 high-emission heat sources. This funding could be obtained for the following purposes: • Connection to the district heating/cooling network, • Installations of heat sources based on RES (e.g., heat pumps), • Biomass combustion plants, • Electric heating installations, provided that they are supplied from renewable energy sources. In order to support Thermal Energy Company in Wałbrzych, during the heating season, water heat accumulator with a capacity of 10,000 m^3 and a capacity of 3 MW would be installed. This battery will be able to store surplus heat, which can be distributed with an increase in the demand of residents for thermal energy. The battery will be able to equalize the operation of the CHP plant in the daily cycle, enabling an increase in production in cogeneration. As a result, the heat accumulation system will also make it possible to avoid the need to use peak devices, i.e., those with high power that support the production of heat when the demand for them increases rapidly.
Background and justification of action	A significant part of the city (50% of the city's area), mainly in the south, is not covered by the supply of heat from the municipal network. Residential and commercial premises are mainly heated from small individual heat sources. Poor ventilation of the city and the use of individual coal and its products for heating contribute to the development of typical autumn-winter smog derived from low emissions, which translates into exceedances of PM_{10} and $PM_{2.5}$ concentrations during this period. Therefore, it is necessary to modernize heat sources supported or preceded by raising public awareness of the effects of using outdated and non-ecological heat sources. The city's activities should aim at replacing coal sources with others, e.g., such solutions are: cogeneration system, biomass boilers, solar and photovoltaic installations, heat pumps. In parallel, the expansion of the city's district heating network should be conducted. Wałbrzych will raise more funds for the further implementation of the program of replacement of high-emission heat sources. Since 2014, the Wałbrzych commune has been consistently implementing a number of heat source replacement programs, also from its budget (a total of 1,314 subsidies were granted).

<table>
<tr><td rowspan="3">Schedule</td><td>Action implementation steps</td><td>2023</td><td>2024</td><td>2025</td><td>2026</td><td>2027</td><td>2028</td><td>2029</td><td>2030</td></tr>
<tr><td>Creation of a special fund to continue the implementation of the assumptions of the program "Replacement of high-emission heat sources in buildings and residential premises in selected municipalities of the Wałbrzych Agglomeration"</td><td colspan="8"></td></tr>
<tr><td>Assembly and installation of a water heat accumulator at Thermal Energy Company in Wałbrzych</td><td colspan="8"></td></tr>
<tr><td>Action owner</td><td colspan="9">Thermal Energy Company in Wałbrzych</td></tr>
<tr><td>Main stakeholders</td><td colspan="9">Environment and Climate Department

Municipal Building Management</td></tr>
<tr><td>Action benefits</td><td colspan="9">• Reduction of greenhouse gas emissions at the level of 13,529 tCO_2

• Lower costs of heating residential buildings and water heating in residential buildings

Methodology:

The reduction from the use of a heat accumulator was estimated at 10,000 tCO_2 per year.

Emission reductions for heat source replacement were estimated on the basis of an ongoing programme, where the replacement of one household heat source on average generated emission savings of 4.4 tCO_2 per year.</td></tr>
<tr><td>Enabling policies, strategies and actions</td><td colspan="9">• Program "Replacement of high-emission heat sources in buildings and residential premises in selected municipalities of the Wałbrzych Agglomeration"

• "Clean Air" program

• Study of the city's spatial conditions and directions

• Assumptions for the heat, electricity and gas fuel supply plan for the Wałbrzych Commune (2019),

• Low-Emission Economy Plan for 2014-2020 with perspective to 2030 for 15 municipalities of the Wałbrzych Agglomeration

• Related to urbanistic objectives of Territorial Just Transition Plan: “Thorough thermal modernization of public and residential buildings, leading to the reduction of energy poverty. This may involve replacement of heat sources and installation of RES equipment, replacement/modernization of central heating and hot water installations or connection to a heating/cooling network”.</td></tr>
</table>

<table>
<tr><td>Result indicators</td><td>• Number of solid fuel heat sources replaced.</td></tr>
<tr><td>Potential to develop inclusivity and improve social aspects</td><td>• Providing people suffering from energy poverty and vulnerable groups with priority access to the program of exchange of high-emission heat sources.
• Providing people suffering from energy poverty and vulnerable groups with subsidies for energy costs, or the possibility of purchasing green electricity produced in the city at preferential prices.
• Creating a support system for residents suffering from energy poverty in the form of municipal energy advisers.</td></tr>
<tr><td>Potential for the implementation of innovative and smart technologies</td><td>• Support the instalation of an optimization software for the network and battery systems.
• Inclusion in the subsidy system of various solutions, such as:
o implementation of installations with two or more heat sources
o support for home energy storage from RES.</td></tr>
<tr><td>Mapping of risks, challenges</td><td>• In Wałbrzych, there are frequent periods when the air temperature falls below 0°C - the burning of solid fossil fuels for heating emits copious amounts of pollutants into the air. The outdated heating system causes frequent breakdowns and interruptions in the heat supply.</td></tr>
<tr><td>Costs</td><td><table><tr><th>Pre-investment</th><th>Capital expenditure</th><th>OPEX</th></tr><tr><td></td><td>PLN 47,783,000
EUR 10,261,000</td><td></td></tr></table>Potential forms of savings
• The continuation of the subsidy programme for the replacement of low carbon heat sources will ultimately allow residents to reduce their heat bills.
• The construction of a water heat accumulator will enable already generated surplus heat energy to be retained in circulation, avoiding the costs associated with re-generating lost surpluses.</td></tr>
<tr><td>Cost calculation</td><td>Data source: wymianakotlow.pl, EU Grants Map, Wałbrzych City Hall, Veolia

Capital expenditures assume further continuation of the program of granting subsidies to city residents for the replacement of high-emission heat sources in buildings and residential premises in Wałbrzych. The average amount of the grant given was determined on the basis of the program "Exchange of high-emission heat sources in buildings and residential premises in selected municipalities of the Wałbrzych Agglomeration". It is assumed that in the years 2023-2030, 100 subsidies for residents in the amount of a maximum of PLN 38,000 will be granted annually - PLN 30,408,000 (EUR 6,530,000).

The cost of building a water heat accumulator was estimated on the basis of a similar project in Poznań, where investments were made in the construction of a</td></tr>
</table>

	water heat accumulator with a capacity of 24,000 m^3 for PLN 41.7 million. Thermal Energy Company assumes the construction of a similar unit with a capacity of 10 thousand m^3 and a capacity of 3 MW - PLN 17,375,000 (EUR 3,731,000).
Financing mechanisms / source	1. *National Recovery Plan* • B1.1.1. Investments in heat sources in district heating systems, subsidies • B1.1.2. Replacement of heat sources and improvement of energy efficiency in residential buildings, subsidies • B2.2.1. Development of transmission networks, smart electricity infrastructure, subsidies • B2.2.2 RES investments carried out by energy communities (including local government units), subsidies • B3.4.1. Investments for a comprehensive green transformation of cities, grants 2. *European Funds programme for Infrastructure, Climate, Environment 2021–2027* • Objective 2.2. Promotion of renewable energy o CODE 41. Energy efficiency renovation of existing residential buildings, demonstration projects and support actions, o CODE 48. Solar renewable energy, o CODE 52. Other RES (including geothermal), o CODE 53. Smart energy systems and related storage, o CODE 54 - High-efficiency cogeneration, heating and cooling system, o CODE 55 - High-efficiency cogeneration, an efficient heating and cooling system with low emissions over the life cycle. 3. *NFOŚiGW, Energy Plus Program, preferential loans,* 4. *ProgramPolSEFF (Polish Sustainable Energy Financing Facility)* 5. *Loans, credits, green bonds,* 6. *The city's own funds.*
Impact on the implementation of the sustainable development goals	

B2 Creating a program of deep thermal modernization and revitalization of municipal buildings in the city

Timescale	Sector	Type of action	Objectives/ priorities
2023-2030		Capital investment	C3 - Increasing the energy efficiency of infrastructure and buildings

Description and scale of action

Development of a standards/good practices for deep thermal modernization and revitalization of municipal buildings in the city, energy consumption standards, including public buildings, schools, administrative and recreational facilities, as well as historic buildings and other types of residential buildings owned by the city. The energy inefficiency of buildings results in the largest share of this sector in the emission of greenhouse gases to the atmosphere in the city. Thermomodernisation works should be related primarily to:

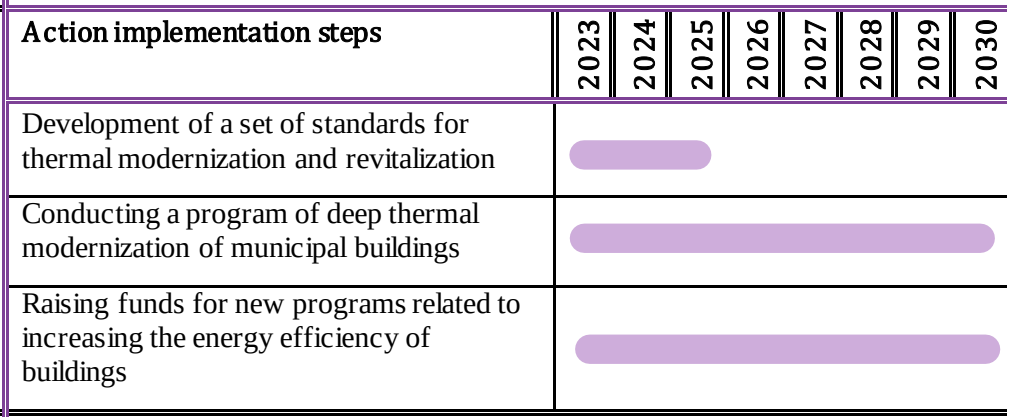
- Complete replacement of window frames and doors with more energy-efficient ones,
- Installation of insulation of external walls and insulation of other partitions, such as ceilings, floors and roofs,
- Replacement of the heating system or heating device,
- Installation of smart energy meters (energy cost metering devices).

Deep thermomodernisation may additionally cause the need to conduct the following works:

- Liquidation of individual heat sources and construction of a connection to the heating system,
- Modernization of ventilation and air conditioning systems,
- Modernization of internal electrical installation and lighting,
- Modernization of the internal installation of central heating and domestic hot water,
- Use of renewable energy sources, such as a heat pump for the building's own needs.

For this reason, in Wałbrzych, there are plans to conduct thermo-modernization projects of municipal buildings in the period 2023-2030. A total of 10 such investments are planned to be carried out annually. These activities should be carried out in parallel with the implementation of a set of training and instructional materials on the requirements and obligations to be included in the design documentation prepared for the renovation of buildings and new facilities.

As part of the thermomodernization (construction) work, the focus should be on solutions to improve accessibility to buildings for vulnerable groups. For this reason, to counteract the exclusion of these people and to help them in their daily life, it is proposed for example: ramps for people with limited mobility, overlays for intercoms or completely new intercoms in buildings, signs on the steps of buildings, street names and building number plates in Braille should be installed in retrofitted buildings.

Background and justification of action	Ninety percent of the buildings targeted for thermomodernization were built before the Second World War. The challenge is additionally demanding because these buildings do not have a repeatable functional layout, bathrooms and ventilation. The above-average height of the flats, which even exceeds 3.2 m, is also a problem, which results in difficulties with adequate and efficient heating of such premises. In addition, it is necessary to replace solid fuel and oil heat sources with highly efficient RES heating sources. Due to the aforementioned factors, there is an absolute need here for the complete reconstruction of these buildings together with their thermomodernization. Only such activities will make it possible to significantly increase the energy efficiency of these buildings. The city owns 511 municipal housing buildings. 153 buildings out of this group are entered in the register of monuments. So far, the city has completed 70 investments aimed at thermal modernization of residential buildings, 13 of which were conducted on a group of buildings entered in the register of monuments. There is a large number of historic buildings in Wałbrzych that require high financial outlays for their maintenance and a long administrative path of preparation for revitalization and deep thermal modernization (including the consent of the conservator). In addition, there is a need for a programme specifying procedures to be followed in cases where the conservation supervision of buildings is an obstacle to conducting thermomodernisation (e.g., conducting a comprehensive programme for replacing coal stoves).
Schedule	
Action owner	Municipal Board of Buildings
Main stakeholders	Revitalization and Spatial Planning Department Organizational Department Education and Social Affairs Department Real Estate Management and Municipal Property Department Local Department
Action benefits	• Reduction of greenhouse gas emissions at the level of 6,508 tCO_2 Methodology: On the basis of ongoing programmes, it has been determined that thermal modernisation of one building on average generates savings of 53 MWh/year.

	For the scope of the action, the total heat energy savings are 2,450 MWh/year. A heat emission factor of 0.332 tCO_2/MWh was assumed.
Enabling policies, strategies and actions	• The Municipal Revitalization Program of the city of Wałbrzych for the years 2016 – 2025 • Study of the city's spatial conditions and directions • Related to urbanistic objectives of Territorial Just Transition Plan: "Thorough thermal modernization of public and residential buildings, leading to the reduction of energy poverty. This may involve replacement of heat sources and installation of RES equipment, replacement/modernization of central heating and hot water installations or connection to a heating/cooling network".
Result indicators	• Number of urban building renovations conducted in accordance with the developed standards. • Number of courses / trainings conducted in the aspect of revitalization / thermal modernization.
Potential to develop inclusivity and improve social aspects	• Developing standards / best practices considering the aspects of accessibility and the principles of universal design, with particular emphasis on the needs of people with disabilities, people with reduced mobility, visually impaired, the elderly, parents with children. • Providing people suffering from energy poverty and vulnerable groups who are residents of the municipal housing buildings, with subsidies for energy costs, or the possibility of purchasing green electricity produced in the city at preferential prices. • Developing a program of energy advisers who would provide information on energy spending and saving patterns, which will be available to households suffering from energy poverty and vulnerable groups. • Potential for capacity building and skill learning of the designers and those responsible for future thermo-modernization upgrading.
Potential for the implementation of innovative and smart technologies	• Creation of a database/map of electricity and heat consumption in the city using newly installed energy meters in buildings where thermomodernisation has been conducted. • Development and implementation of an application to track electricity and heat consumption using newly installed energy meters in buildings where thermomodernisation has been conducted. Developing a system in which residents can check their electricity and heat consumption, thus educating, raising awareness and encouraging savings. Working this out would help residents to consciously control their consumption and related expenditure. • During the modernization of buildings, buildings should be equipped with heat smart meters (HVAC sensors to automate and optimise heatings in buildings). In addition, an approach can be suggested for connecting buildings with each other via smart grid infrastructure. • In a further step, the city should include the data from thermal imagery and smart meters in a GIS, or digital twin, to eailsy identify and prioritize

<table>
<tr><td></td><td colspan="3">interventions. Data should be made public to enable private sector to identify buisness and users opportunities.</td></tr>
<tr><td>Mapping of risks, challenges</td><td colspan="3">• A significant part of municipal buildings is in an extremely poor technical condition, which leads to difficulties in conducting effective thermal modernization. The development of standards / the best in this regard will allow to counteract this risk.
• Low-strength buildings, out-of-life buildings can cause unpredictable costs at the time of modernization. For this reason, it can be expected that there will be non-expected cost items in the budgets.</td></tr>
<tr><td rowspan="4">Costs</td><td>Pre-investment</td><td>Capital expenditure</td><td>OPEX</td></tr>
<tr><td></td><td>PLN 254,350,000
EUR 54,621,000</td><td></td></tr>
<tr><td colspan="3">Potential forms of savings</td></tr>
<tr><td colspan="3">PLN 3,663,234
EUR 786,680
• For the scope of the action, total heat energy savings amount to 2,450 MWh per year. The unit heat price for the city of Wałbrzych was assumed at 0.19 PLN/MWh.</td></tr>
</table>

Cost calculation

Data source: Budget of the city of Wałbrzych for 2022, Town Hall in Wałbrzych, Guidance on the use of consistent macroeconomic indicators as a basis for estimating the financial impact of proposed acts. Update - October 2022.

Based on 46 investments in the thermo-modernization of municipal residential buildings included in the budget of the city of Wałbrzych for 2022, the average cost of thermal modernization of a municipal building per 1 m^2 of area was estimated – PLN 5,015 (these values ranged from PLN 2,431 per m^2 to PLN 8,775 per m^2). Based on these investments, the average area of municipal residential buildings was also estimated – 516.16 m^2 (these values ranged from 168 m2 to 1 337 m^2). Based on the indicated average values, the cost of modernization of one communal residential building in 2022 was estimated at PLN 2,588,000. Due to the current economic situation and the global increase in the prices of products and services, it was decided to use the guidelines of the Ministry of Finance on the use of consistent macroeconomic indicators to index the costs of thermomodernisation of buildings annually. It is assumed that 10 investments in the thermomodernisation of buildings will be conducted annually, considering the fact that this value may change for procedural reasons, e.g., for the duration of the public procurement process, finding a contractor, ordering materials, evicting and finding substitute housing for the period of construction work for residents). For this purpose, the projected price increase (% year-on-year), the average cost of thermomodernisation of 1 building and the total cost of thermomodernisation for a given year are presented.

Year	Consumer price inflation	Average cost of thermomodernisation of 1 building (PLN)	Total annual cost of thermomodernisation of 10 buildings (PLN)
2022	Base year	2,588,000	
2023	9.8%	2,842,000	28,420,000
2024	4.8%	2,978,000	29,780,000
2025	3.1%	3,071,000	30,710,000
2026	2.5%	3,147,000	31,470,000
2027	2.5%	3,226,000	32,260,000
2028	2.5%	3,307,000	33,070,000
2029	2.5%	3,390,000	33,900,000
2030	2.5%	3,474,000	34,740,000
Sum			PLN 254,350,000 (EUR 54,621,000)

Financing mechanisms / source

1. *National Recovery Plan*

- B1.1.2. Replacement of heat sources and improvement of energy efficiency in residential buildings, subsidies
- B2.2.2 RES investments carried out by energy communities (including local government units), subsidies

	• B3.4.1. Investments for a comprehensive green transformation of cities, grants
	2. *European Funds programme for Infrastructure, Climate, Environment 2021–2027*
	• Objectives 2.2. Supporting renewable energy
	  ○ CODE 41. Energy efficiency renovation of existing residential buildings, demonstration projects and support actions,
	  ○ CODE 48. Renewable solar energy,
	  ○ CODE 52. Other types of RES (including geothermal energy),
	  ○ CODE 53. Smart energy systems and related storage,
	3. Just Transition Fund
	• investments in the deployment of technologies and systems and infrastructure for affordable clean energy, energy storage, reduction of greenhouse gas emissions, development of RES and improvement of energy efficiency, including for the purpose of reducing energy poverty,
	4. *NFOŚiGW, Energy Plus Programme, preferential loans,*
	5. *ProgramPolSEFF (Polish Sustainable Energy Financing Facility)*
	6. *Loans, credits, green bonds,*
	7. *Own resources of the city.*

Impact on the implementation of the sustainable development goals	

B3 Tackling energy poverty

Timescale	Sector	Type of action	Objectives/ priorities
2023-2030		Capital investment	C4 – Providing accessible, high-quality services, social and housing infrastructure

Description and scale of action	As part of this action, it is recommended to establish a dedicated fund for households at risk of energy poverty. The amount of the subsidy or co-financing will constitute the cost of implementation of projects limiting the emission of pollutants into the air and improving the energy efficiency of buildings through the implementation of low-emission projects for the least wealthy households in single-family residential buildings, including members who are entitled to cash benefits. This co-financing can be used by households for the following low-emission projects: • Replacement of heating devices or systems that heat single-family residential buildings or devices or systems for heating domestic water in these buildings, which do not meet the standards, with those that meet low-emission standards, • Liquidation of heating devices or systems heating single-family residential buildings or domestic water heating devices or systems in those buildings that do not meet low-emission standards, as well as connecting a single-family residential building to the heating, electricity, or gas network, or modernising this connection, including the necessary installation in these buildings of heating devices or systems heating single-family houses or domestic water heating devices and system • Providing a single-family residential building with access to energy from an external renewable energy source installation and access to a heat pump, along with the installation of devices for supplying electricity from this installation and the installation of necessary heating devices or systems in these buildings for heating single-family residential buildings or water heating devices or systems utilitarian.
Background and justification of action	According to the report "The phenomenon of energy poverty in Poland, including those living in single-family houses", Institute for Structural Research, April 2018, the scale of entities at risk of energy poverty living in single-family houses, in cities with more than 100,000 inhabitants' persons affects 7.8% of households. According to the data of the Municipal Social Welfare Center in Wałbrzych, this phenomenon in the city is more than twice as large as according to the estimates of the above-mentioned study.

<table>
<tr><td rowspan="6">Schedule</td><td>Action implementation steps</td><td>2023</td><td>2024</td><td>2025</td><td>2026</td><td>2027</td><td>2028</td><td>2029</td><td>2030</td></tr>
<tr><td>An in-depth analysis of the level of energy poverty among households in the city.</td><td colspan="8" rowspan="5">  </td></tr>
<tr><td>Legislative actions of the City Council enabling the launch of the assumed fund and a subsidy program for the poorest.</td></tr>
<tr><td>Commencement of the grant application procedure.</td></tr>
<tr><td>Payment of subsidies for the poorest inhabitants.</td></tr>
<tr><td>Monitoring and controlling the manner of expenditure of subsidies by residents.</td></tr>
<tr><td>Action owner</td><td colspan="8">Organizational Department</td></tr>
<tr><td>Main stakeholders</td><td colspan="8">Municipal Social Welfare Center in Wałbrzych
Education and Social Affairs Department</td></tr>
<tr><td>Action benefits</td><td colspan="8">• Improving the living conditions and comfort of the inhabitants
• Improving air quality and energy efficiency</td></tr>
<tr><td>Enabling policies, strategies and actions</td><td colspan="8">• Program "Replacement of high-emission heat sources in buildings and residential premises in selected municipalities of the Wałbrzych Agglomeration"
• "Clean Air" Program
• Assumptions for the heat, electricity and gas fuel supply plan for the Wałbrzych Commune (2019)
• Related to urbanistic objectives of Territorial Just Transition Plan: “Thorough thermal modernization of public and residential buildings, leading to the reduction of energy poverty. This may involve replacement of heat sources and installation of RES equipment, replacement/modernization of central heating and hot water installations or connection to a heating/cooling network”.</td></tr>
<tr><td>Result indicators</td><td colspan="8">• Amount of funds allocated to financial aid for households suffering from energy poverty [PLN].</td></tr>
<tr><td>Potential to develop inclusivity and improve social aspects</td><td colspan="8">• Developing a program of energy advisers who would provide information on energy spending and saving patterns, which will be available to households suffering from energy poverty and vulnerable groups.
• Develop business models and financing schemes to improve low-income residents' access to modern energy services that can be linked to an on-going financing system. This will avoid credit mechanisms for lower income households.</td></tr>
</table>

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<tr><td>Potential for the implementation of innovative and smart technologies</td><td>

- Possibility to work with companies or start-up providing clean energy solutions, such as solar thermal system on pay as you go basis, sparing household the need to invest in the technology.
- Development of solutions that will help define and monitor the scale of energy poverty among residents, based on socio-economic data.
- Collaboration with the Municipal Social Assistance Center and University to leverage different dataset in order to develop an "energy poverty" map of the city.

</td></tr>
<tr><td>Mapping of risks, challenges</td><td>

- In the city, the significant risks are poverty and mounting social problems, as well as dependence on imported fossil fuels and the rising cost of living due to worsening inflation. For this reason, there is a need to develop support systems for residents.

</td></tr>
<tr><td>Costs</td><td>
<table>
<tr><th>Pre-investment</th><th>Capital expenditure</th><th>OPEX</th></tr>
<tr><td></td><td>PLN 466,400,000
EUR 100,159,000</td><td></td></tr>
<tr><td colspan="3">Potential forms of savings</td></tr>
<tr><td colspan="3">

- The development of the operation of this subsidy scheme will ultimately allow residents to reduce their electricity and heating bills.

</td></tr>
</table>
</td></tr>
<tr><td>Cost calculation</td><td>Data source: STOP SMOG – Clean Air Programme, Municipal Social Welfare Centre in Wałbrzych

Capital expenditure is the total value of the fund for providing subsidies to households at risk of energy poverty. The amount of the subsidy was determined on the basis of the existing national STOP SMOG – Clean Air Program in the amount of PLN 53,000 for one household. The number of households at risk of energy poverty was indicated by the Municipal Social Welfare Center in the amount of 8,800 - PLN 466,400,000 (EUR 100,159,000).</td></tr>
<tr><td>Financing mechanisms / source</td><td>

1. *National Recovery Plan*

- B1.1.2. Replacement of heat sources and improvement of energy efficiency in residential buildings, subsidies
- B2.2.2 RES investments carried out by energy communities (including local government units), subsidies
- B3.4.1. Investments for a comprehensive green transformation of cities, grants

2. *European Funds programme for Infrastructure, Climate, Environment 2021–2027*

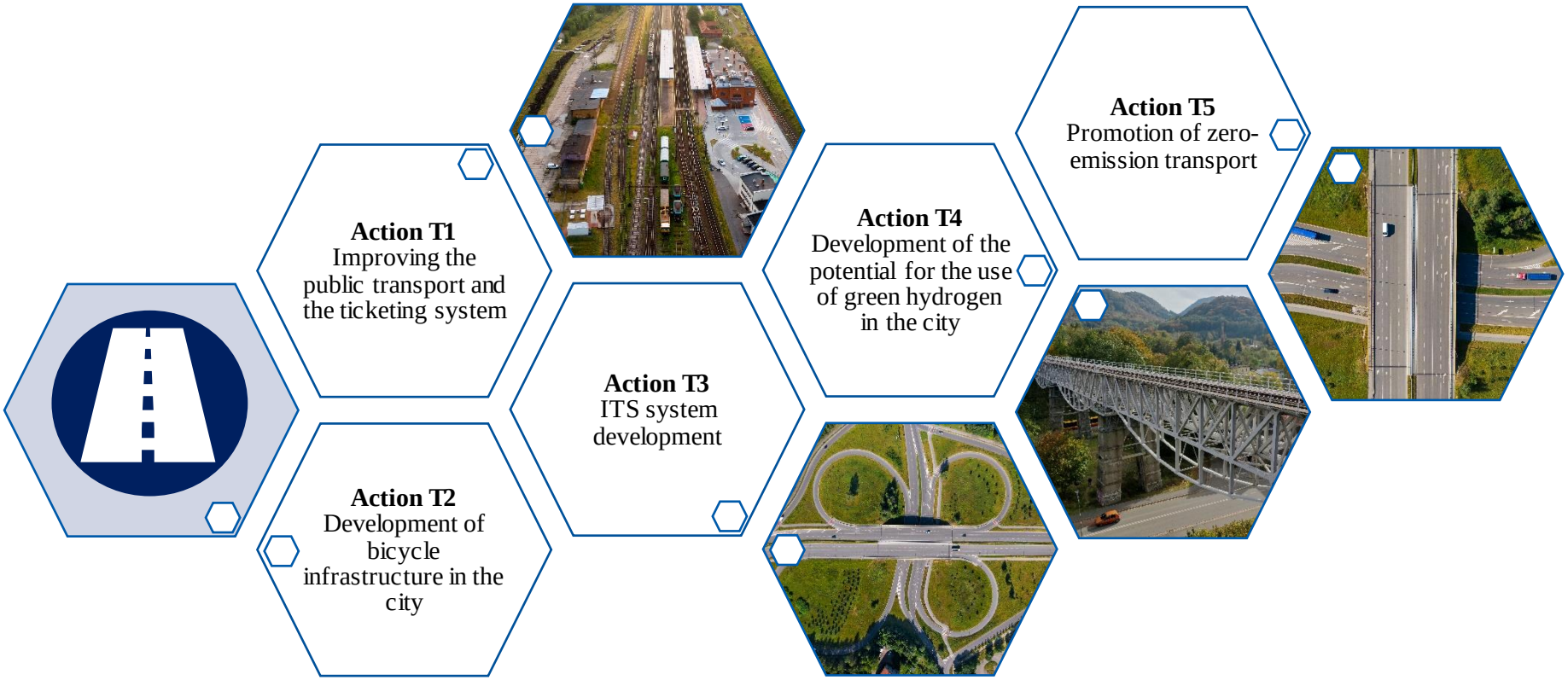
- Objective 2.2. Supporting renewable energy
  - CODE 41. Energy efficiency renovation of existing residential buildings, demonstration projects and support actions,
  - CODE 48. Renewable solar energy,
  - CODE 52. Other types of RES (including geothermal energy),

3. *NFOŚiGW, STOP SMOG Programme – Clean Air, Energy Plus Programme, preferential loans,*

</td></tr>
</table>

	4. *ProgramPolSEFF (Polish Sustainable Energy Financing Facility)* 5. *Own resources of the city.*
Impact on the sustainable development goals	

SECTOR: TRANSPORT



T1 Improving the public transport and the ticketing system			
Timescale	**Sector**	**Type of action**	**Objectives/ priorities**
2023-2027		Capital investment	C5 - Supporting environmentally friendly, safe and integrated transport
Description and scale of action	In order to improve the comfort and quality of traveling in the city, the passenger information system should be expanded. For this purpose, all existing and modernized bus shelters should be equipped with Dynamic Passenger Information (DPI) boards. It is important to ensure that the system is available in multiple foreign languages to facilitate travel for both foreign tourists and refugees who are currently in Wałbrzych. In addition, it is recommended that 75 bus shelters (50% of the total) in the city will be replaced with green bus stops, which are a modern and ecological solution, bringing numerous benefits to both the environment and residents. Green bus stops use rainwater, solar energy and contribute to increasing the amount of oxygen. In addition, they make the waiting time of passengers for buses more pleasant and improve the aesthetics of bus shelters. As part of this project, you can equip the shelters with a green roof, a green wall all over the carport, a solar station powering the carport lighting, an information display case and USB chargers. Social inclusion and the reduction of barriers to the use of public transport should also be considered (ensuring that each stop is equipped with infrastructure to facilitate the boarding/disembarkation of disabled passengers, seniors or children). The city and local carriers should also establish cooperation with commercial enterprises offering services related to travel planning by public transport, enabling the planning of travel between any points in the city, purchasing tickets and providing information on the current public transport timetable (development of an integrated mobile application).		
Background and justification of action	In 2022, the city conducted the "Project of optimal reorganization of the Wałbrzych public transport network", in which the concept of changes in the layout of the communication line network was defined, which has a significant, positive impact on the implementation of the assumptions presented as part of this action. Simultaneously with the adaptation, reconstruction and repair of roads, the city is trying to periodically modernize bus stops. 150 bus stops in the city are equipped with bus shelters, and 51 of them with dynamic passenger information boards - DIP. In order to improve the comfort and quality of traveling around the city, the passenger information system should be expanded. For this purpose, all existing and modernized bus shelters should be equipped with DIP boards. There are currently several unrelated applications in the city, which have varying functionalities. This complicates their usage and potential for wider deployment. The problem is a lack of system integration.		

Schedule	**Action implementation steps**	2023 2024 2025 2026 2027 2028 2029 2030
	Installation of Dynamic Passenger Information boards	
	Obtaining funding to upgrade bus shelters and the DIP system	
	Implementation of the bus shelter replacement/modernisation programme	
Action owner	Road, Transport and City Maintenance Authority in Wałbrzych	
Main stakeholders	City Promotion Department Revitalization and Spatial Planning Department	
Action benefits	• Intensification of the use of public transport in the city by providing convenient transfer places and stops. • Green bus stops will ensure greener in the road lane, effective retention of rainwater, improvement of air quality, lowering the temperature and improvement of the microclimate.	
Enabling policies, strategies and actions	• Plan for Sustainable Development of Public Transport for the Wałbrzych Commune (updated, 2021) • Plan for the sustainable development of public transport in Wałbrzych and Szczawno-Zdrój • Related to the urbanistic objectives of the Territorial Just Transition Plan: "investments in smart and sustainable local mobility, including the purchase of low-emission and emission free rolling stock for public transport (including rolling stock) and accompanying infrastructure, including charging points for public transport vehicles, bicycle paths, transfer points, revitalization of railway lines in order to restore the possibility of their functioning" • Implementation of ITS in the city	
Result indicators	• Replacement of 75 bus shelters for the green bus stops • Installation of 150 Dynamic Passenger Information boards	
Potential to develop inclusivity and improve social aspects	• Construction of new bus shelters considering the aspects of accessibility and the principles of universal design, with particular emphasis on the needs of people with disabilities, people with reduced mobility, visually impaired, the elderly, parents with children. • Construction of new bus shelters considering safety of passengers and especially potentially vulnerable groups (e.g., women, minors, minorities, etc.), in terms of the design (e.g., bus cage capacity), illumination, etc. • Ensuring that the bus shelters have designated areas for parking bicycles to enable mixed-mode commuting.	

	• Potential for the Dynamic Passenger Information Boards to include audio information to help visually impaired people find their way around the network independently. Information posted on Boards available in various foreign languages, facilitating travel for foreign tourists as well as refugees. • Potential to improve the public transport by including additional bus/rail lines (daytime and nighttime). Optimized public transportation schedules would meet the needs of the citizens, affect their quality of life and increase safety while commuting.
Potential for the implementation of innovative and smart technologies	• Development of a dedicated travel planning application encouraging residents to use public transport. The application, through the possibility of combining with dynamic passenger information, could inform in real time which connections should be chosen to make the journey most effective for travelers. In addition, the application could contain functionality related to the purchase of both single and monthly tickets, which would increase the availability of public transport. Wałbrzych, like many cities in Poland, struggles with the problem of an aging society, and for this social group, public transport is often the main means of communication between services in the city.
Mapping of risks, challenges	• The city is projected to experience elevated temperatures and an increase in the frequency of heat waves, i.e., heat waves that may increase the risk of heat stress, especially in particularly vulnerable populations. Extreme elevated temperatures can also be aggravated by the urban heat island effect, where large clusters of sidewalks, buildings and other man-made structures absorb and trap heat. Increasing the green area by implementing green stop infrastructure solutions and shelters with a roof protecting against UV radiation will help mitigate the identified risks.
Costs	**Pre-investment** / **Capital expenditure** / **OPEX** PLN 600,000 / PLN 16,500,000 / PLN 525,000 EUR 128,800 / EUR 3,543,000 / EUR 112,700 **Potential forms of savings** -
Cost calculation	Data source: Town Hall in Wałbrzych, InVałbrzych, FPP Enviro, Płock Transport Service, Projects Brwinów, Municipal Transport Company Sp. z o. o. with its seat in Stargard, Communal Union of Municipalities "Inter-Communal Communication" in Olkusz, Public Information Bulletin of Gdynia City Hall. Pre-investment costs represent the estimated expenditure associated with the development of a multi-discipline design for 75 bus shelters, so that assumptions such as appropriate vegetation, installation of a solar station, USB chargers are met. The costs have been estimated based on the costs of similar projects from the civic budget of the city of Minsk Mazowiecki and amount to PLN 600,000 (EUR 128,800). The capital expenditure represents the estimated cost of replacing 75 bus shelters with green bus stops, which was determined on the basis of public procurement and amounted to an average of PLN 100,000 for the fabrication of elements, delivery

	and installation of one green bus shelter and planting of plants. The estimated cost of the entire investment will be around PLN 7,500,000 (EUR 1,610,000). The cost of installing 150 dynamic passenger information boards was also determined on the basis of public procurement and amounted to approximately PLN 60,000 for 1 DIP board - The cost of realising the entire investment will amount to approximately PLN 9,000,000 (EUR 1,932,000). Operational costs represent annual expenses for the care of the planted greenery on 75 new green bus shelters. The cost of caring for one such bus stop has been estimated at approximately PLN 7,000 per year.
Financing mechanisms / source	1. *National Reconstruction Plan* • B3.4.1 Investments for complex green transformation of cities, loans. 2. *European Funds for Infrastructure, Climate, Environment 2021-2027* • Objective 2.8 Promote sustainable multimodal urban mobility as part of the transformation towards a zero-carbon economy, o CODE 84 Digitisation of urban transport, grants. 3. *National Fund for Environmental Protection and Water Management, LIFE Programme,* 4. *Norwegian Funds subsidies,* 5. *City's own resources.* 6. *Private sector sponsorship*
Impact on the implementation of the sustainable development goals	

T2 Development of bicycle infrastructure in the city

Timescale	Sector	Type of action	Objectives/ priorities
2023-2026		Capital investment	C5 - Supporting environmentally friendly, safe and integrated transport

Description and scale of action

Wałbrzych is currently preparing a plan for the development of bicycle paths in the city. It is planned that an additional 30 km of bicycle paths should be created in the road lane in order to fully meet the needs of residents. In recent years, an analysis of the residents' needs regarding bicycle shelters was also conducted, in which it was indicated that there is a need to build 20 new bicycle shelters and parking lots in the city. In addition, areas where there is a need and the possibility of building a new pedestrian and bicycle route have been identified:

- Ogrodowa Street- 707 m,
- Prostopadła Street - 750 m,
- Orkana Street - 190 m,
- Jachimowicza Street – 250 m,
- Villardczyków Street - 350 m,
- Along the newly built road at Villardczyków Street – 1,170 m.

In addition, it is also planned to build bicycle routes on Wrocławska Street, Armii Krajowej Street, Andersa Street, Dąbrowskiego Street, Przyjaciół Żolnierza Street and Wilczej Street.

Investments in basic communication infrastructure will intensify cooperation with commercial companies offering electric bicycle and scooter rental services.

Background and justification of action

In Wałbrzych, a plan for the development of bicycle paths in the city is currently being prepared. The city is active and raises funds for this purpose - in 2022 it launched a project as part of the KPO (National Reconstruction Plan) aimed at improving the connection of the Wałbrzych Special Economic Zone with other parts of the city in this way.

An electric scooter rental system has been operating in the city since February 2022. The development of a network of bicycle paths in conjunction with the possibility of renting bicycles and electric scooters will popularize active mobility in the city.

Schedule

Action implementation steps	2023	2024	2025	2026	2027	2028	2029	2030
Preparing project documentation								
Construction work for bicycle paths and installation of bicycle shelters								

Action owner

Road, Transport and City Maintenance Authority in Wałbrzych

Main stakeholders	Transport and Road Traffic Department
Action benefits	• Improving the safety of pedestrians and cyclists. • Improving the convenience of cycling connections and increasing active mobility with the use of ecological means of transport.
Enabling policies, strategies and actions	• Plan for Sustainable Development of Public Transport for the Wałbrzych Commune (updated, 2021) • Plan for the sustainable development of public transport in Wałbrzych and Szczawno-Zdrój • Study of the conditions and directions of spatial development of the city Related to the urbanistic objectives of the Territorial Just Transition Plan for the Wałbrzyski Subregion: "investments in smart and sustainable local mobility, including the purchase of low-emission and non-emission rolling stock for public transport (including rolling stock) and accompanying infrastructure, including charging points for public transport vehicles public, bicycle paths, transfer points, revitalization of railway lines in order to restore the possibility of their functioning" • Road Safety Improvement Program for the city of Wałbrzych until 2023 - Zero accidents"
Result indicators	• Construction or designation of up to 30 km of new cycle routes • Construction of at least 20 new bicycle shelters and parking lots
Potential to develop inclusivity and improve social aspects	• Considering the rules and requirements a of safety and universal design in terms of the development of pedestrian and bicycle infrastructure. • Planning the locations of bicycle shelters and parking lots taking into account the needs and commuting patterns of the citizens, enabling them to switch to bicycle commuting or mixed-mode commuting.
Potential for the implementation of innovative and smart technologies	• Further development of the system for renting and sharing bicycles and electric scooters. Shared mobility services, such as bikes and scooters, should be integrated within the actual public transport offer avoid the multiplication of non-integrated shared mobility services. • The city can leverage data already available through bike mobile app to understand bike behaviour patterns. • Potential to incentivize biking by using an app that reward bikers with vouchers to buy goods in local shops.
Mapping of risks, challenges	• Extending the rental system with electric bikes and scooters is a solution that counteracts the risk of using this type of transport in a city with an unfavorable spatial layout, diversified in terms of landform.
Costs	**Pre-investment** / PLN 350,000 — **Capital expenditure** / PLN 24,476,200 — **OPEX** / PLN 11,600

	EUR 75,000	EUR 5,256,300	EUR 2,500
	Potential forms of savings		
	• Further development of the cycling infrastructure in the city will result in residents being able to save money on buying fuel for individual personal vehicles.		
Cost calculation	Data source: Municipal Office in Wałbrzych, The Costs of Cycling Infrastructure - European Cyclists' Federation, Municipal Roads Authority in Warsaw, Civic Budget Warsaw, Civic Budget of Mazovia, City Hall of Sopot, Kraków Civic Budget, District Starost Office in Konin.		
	Pre-investment costs are the costs of preparing the relevant technical documentation and/or functional-utility concepts for pedestrian and cycle paths. They were estimated on the basis of similar investments conducted in Kraków, Sopot and Gabin-Dobrzyków. The total estimated cost is PLN 350,000 (EUR 75,000). As part of the action, it is planned to make and install 20 bicycle shelters, the estimated cost of which was determined on the basis of a public contract for the construction and installation of 30 bicycle shelters in locations indicated by the ordering party. The average cost is in the range of PLN 25.8 thousand – PLN 42.2. The total estimated cost is PLN 609,000 (EUR 130,000). In addition, places where there is a need to build a pedestrian and bicycle route have been identified. According to a report compiled by the European Cyclists' Federation, the cost of building 1 m, of a 'velo-path' costs around PLN 7,000. 1. St. Ogrodowa – PLN 4,938,300 (EUR 1,060,500) 2. St. Prostopadła – PLN 5,238,700 (EUR 1,125,000) 3. St. Orkana - PLN 1,327,100 (EUR 285,000) 4. St. Jachimowicza – PLN 1,746,200 (EUR 375,000) 5. St. Villardczyków – PLN 2,444,700 (EUR 525,000) 6. Along the newly built road on St. Villardczyków - PLN 8,172,300 (EUR 1,755,000) In addition, cycle routes are also planned on Wrocławska Street, Armii Krajowej Street, Andersa Street, Dąbrowskiego Street, Przyjaciół Żołnierza Street and Wilcza Street. The total estimated capital cost associated with the construction of new bicycle routes is approximately PLN 23,867,300 (EUR 5,256,300). Operating costs represent the annual cost of maintaining the current vertical and horizontal signage of the pedestrian and cycle route. The estimated amount is PLN 11,600 (EUR 2,500) per year.		

Financing mechanisms / source	1. *National Reconstruction Plan*
	• E2.2.1. Investment in transport safety, grants,
	• B3.4.1 Investments for comprehensive green transformation of cities, loans.
	2. *European Funds for Infrastructure, Climate, Environment programme 2021-2027*
	• Objective 2.8 Supporting sustainable multimodal urban mobility as part of the transformation towards a zero-carbon economy,
	  ○ CODE 81 Clean urban transport infrastructure,
	  ○ CODE 84. Digitisation of urban transport, subsidies.
	3. *City's own resources.*

Impact on the implementation of the sustainable development goals	

T3 Development of the ITS system			
Timescale	**Sector**	**Type of action**	**Objectives/ priorities**
2023-2027		Capital investment	C6 - Improving the functioning of urban infrastructure through the development of innovative technologies and digital transformation
Description and scale of action	By implementing a Smart Transport System in the entire city area, the quality, comfort, and efficiency of travel by both individual and public transport should be improved. A more optimal use of the transport network through guidance on alternative routes and continuous access to traffic data will provide the opportunity for efficient traffic management. The essential areas to be included in the ITS (including installation of information boards) operation will be the crucial streets, intersections, and the newly built city ring road. The system should include Wrocławska Street with the intersection with Piastów Śląskich Street, de Gaulla Street, Lellewel Street, Noworudzka Street, Strzegomska Street, Kamieniecka Street, Sikorskiego Street, Wysockiego Street, Grunwaldzki Square, 1 go Maja Street, Zachodnia Street, Andersa Street, Żeromskiego Street and at the new intersection of Wieniawskiego Street and Podwale Street. This action should include: • A full upgrade of the traffic management system based on the existing infrastructure with the possibility of further updating it with newly planned projects in the city. • Development of a guidance system for parking spaces, for people with disabilities, including the development of a central application offering these services. • Extension of the scope for operating the currently existing urban telecommunications infrastructure, in particular the fibre optic tele transmission network: extension of the existing backbone network and the design and construction of a fibre optic access network to enable electronic communication between the system components installed within the city with the ITS central system, ensuring the transmission of all digital data between these elements, including: camera images, data collected by signal controllers, traveler information, location of public transport means. • Developing a traffic prioritisation system for buses to speed up public transport, the system will be based on actual public transport traffic data on information about deviations from the assumed timetable. • Development and implementation of a traffic model for the street network to enable short-term traffic condition prediction and incorporation of this element into the traffic management and traveler information system. • Connecting this system to other planned projects within the framework of the Wałbrzych Green Vision, including a travel information system, the use of stop signs and an internet portal providing information for travelers (traffic load prediction, information on car parks, location of public transport vehicles, etc.) as well as the possibility of planning journeys that		

	consider actual traffic conditions for individual vehicles and public transport. • Installing a system of signs (including mobile signs) and changeable content signs that provide vehicle drivers with relevant information (about incidents, hazards, recommended detours, parking). • Supply and installation of traffic safety system components: video event detection and extension of video surveillance system.
Background and justification of action	The current functioning Smart Transport System - ITS in Wałbrzych has the development potential to meet the expectations and needs of the residents. The system is fully operational around Kilińskiego Street, Rycerski Square and Szczawienko Railway Station. So far, solutions have been implemented in the city, including: • Mobile information system and ITS portal, • 17 intersections covered by the area traffic control system with priority for public transport vehicles based on the renowned SCATS system implemented in many agglomerations around the world, • CCTV monitoring system at intersections included in the traffic control system, • Public transport management system, • Passenger information system, • Traffic flow control system in the traffic system, • 46 screens of dynamic passenger information, • 5 parking space information screens directing to approx. 600 parking spaces, • Smart City lighting management, • 46 video surveillance cameras, • Modern payment systems for parking and public transport with the use of debit and credit cards as well as smartphones. • Plate recognition cameras for public safety. • Speed limits cameras to decrease of vehicle speeds especially for the most accidently spots.
Schedule	**Action implementation steps** | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 Analysis of the needs and development opportunities of the ITS system Development of ITS system components
Action owner	Smart Transport System Centre

Main stakeholders	Road, Communication and City Maintenance Authority in Wałbrzych Transport and Road Traffic Department
Action benefits	• Increasing the use of public transport. • Reduced number of traffic jams (prioritization of public transport, improvement of the parking system).
Enabling policies, strategies and actions	• Plan for Sustainable Development of Public Transport for the Wałbrzych Commune (updated, 2021) • Plan for the sustainable development of public transport in Wałbrzych and Szczawno-Zdrój • Related to the urbanistic objectives of the Territorial Just Transition Plan: "investments in smart and sustainable local mobility, including the purchase of low-emission and non-emission rolling stock for public transport (including rolling stock) and accompanying infrastructure, including charging points for public transport vehicles public, bicycle paths, transfer points, revitalization of railway lines in order to restore the possibility of their functioning" • Road Safety Improvement Program for the city of Wałbrzych until 2023 - Zero accidents"
Result indicators	• Number of new elements developed within the ITS system [pcs.] • Streets/crossroads covered by ITS • Reduction rates of time spent in traffic.
Potential to develop inclusivity and improve social aspects	• Development of a guidance system to parking spaces, for the people with disabilities, facilitating getting around the city for people with reduced mobility. • Ensuring internet portal that will provide information to travelers includes audio features, to help visually impaired people find their way around the network independently. • Increased safety of citizens, and especially vulnerable groups, through extension of video surveillance system. • Increasing the level of comfort of citizens traveling by public transport.
Potential for the implementation of innovative and smart technologies	• Extension and implementation of an open IT platform integrating elements of the ITS system (website or mobile application). • Development of a central application offering these services for guiding parking spaces in the city. • Fully adapted Smart intersection systems in main intersections of the city. • Implementation of an Automated Traffic Management System - prioritazation of public transport and public service vehicles etc.

<table>
<tr><td>Mapping of risks, challenges</td><td>

- Floods and accidents in transport threatens particularly the road and urban transport subsystem. The risk associated with them results from local flooding, causing congestion and traffic difficulties, especially in the central parts of the city. The development of solutions within the ITS system can help counteract these difficulties and improve the traffic flow system in the city in the event of hazards.

</td></tr>
<tr><td>Costs</td><td>
<table>
<tr><th>Pre-investment</th><th>Capital expenditure</th><th>OPEX</th></tr>
<tr><td>-</td><td>PLN 58,800,000
EUR 12,600,000</td><td>-</td></tr>
<tr><th colspan="3">Potential forms of savings</th></tr>
<tr><td colspan="3">

- An efficient and effective ITS system will help to avoid the costs associated with road traffic collisions both for individual residents and for damaged urban road infrastructure.

</td></tr>
</table>
</td></tr>
<tr><td>Cost calculation</td><td>

Data source: Municipal Office in Wałbrzych, EU subsidies map, official online platforms of municipal authorities of Rzeszów, Kielce, Tarnów, Koszalin.

Capital expenditure was estimated based on public procurement contracts covering the same assumptions for the design and implementation of a Smart Transport System in 4 selected cities in Poland (similar in area). The range of costs for the above-mentioned investments is PLN 31.7 – 88.6 million. Therefore, it was decided to assume an average value of PLN 58.8 million (EUR 12.6 million).

An estimate of exact costs will become possible only after a detailed analysis and identification of the individualised transport needs in the city have been conducted, including the basic infrastructure of the system (e.g., length of new telecommunications networks, number of boards, cameras, etc.).

</td></tr>
<tr><td>Financing mechanisms / source</td><td>

1. *National Reconstruction Plan*

- E2.2.1. Investment in transport safety, grants.

2. *European Funds for Infrastructure, Climate, Environment programme 2021-2027*

- Objective 2.8 Supporting sustainable multimodal urban mobility as part of the transformation towards a zero-carbon economy,
    - CODE 84. Digitisation of urban transport, subsidies.

3. *Just Transition Fund*

- investment in intelligent and sustainable local mobility, including the decarbonisation of local transport and its infrastructure,

4. *Investment loans, green bonds,*
5. *City's own resources.*

</td></tr>
<tr><td>Impact on the implementation of the sustainable development goals</td><td> 
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</table>

T4 Developing the potential for use of green hydrogen in the city			
Timescale	**Sector**	**Type of action**	**Objectives/ priorities**
2023-2027		Capital investment	C5 - Supporting environmentally friendly, safe and integrated transport
Description and scale of action	Hydrogen can be used as a resource, fuel or energy carrier and storage. Its versatility, low or even zero carbon, make it one of the key elements of the energy transition and transport. A detailed study should be conducted on potential areas of hydrogen use and the feasibility of its use in urban infrastructure. A hydrogen programme would identify implementation areas, next steps, pilot projects and long-term development programmes for the use of hydrogen in energy and transport. The programmes would look at how hydrogen can be innovatively produced, stored, used and transported through the network. At the same time, the activities identified here would contribute to the development of competencies and human resources for the hydrogen economy. The action includes the purchase of 20 new buses powered by hydrogen fuel. In addition, one hydrogen refueling station will be built. The development of a hydrogen-enabling infrastructure would be the first step towards advancing the use of green hydrogen in the city. The implementation of this measure may be additionally supported by one of the largest fuel concerns operating in Poland, which has announced that by 2024 a hydrogen filling station will be built in Wałbrzych. In addition, the purchased vehicles can support the development of local tourism by creating a line of additional transport links between the most important attractions in the city (estimated route length is 20 km): Książ Castle, the Palm House, Aqua Zdrój, the Old Mine, the Porcelain Museum, the Evangelical-Augsburg Church of the Redeemer, the Roman Catholic Church of Our Lady of Sorrows, the Collegiate Church of St. Mary of Sorrows and St. John the Baptist. NMP Bolesna and St. Guardian Angels Collegiate Church, Market Square and Jan III Sobieski City Park.	
Background and justification of action	As part of public transport organised by the Wałbrzych Municipality, 13 lines are operated (1, 2, 4, 5, 8, 9, 10, 11, 12, 15, 18, A and C). The frequency of the main (basic) lines is 10 - 15 minutes, the frequency of the supplementary lines is 30 minutes, and the frequency of the peripheral lines is 60 minutes. Transport services have been provided since 2012, by one operator - Silesian Bus Consortium. In 2020, transport on public lines was provided by 56 buses, which made a total of 4,414,821 vehicle-km. The length of the bus routes was 163 km. The city has the potential to produce green hydrogen, but there is a need to create energy storage, build a hydrogen refueling station, which will allow the use of purchased hydrogen-cell buses.		

<table>
<tr><td>Schedule</td><td>
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<tr><th>Action implementation steps</th><th>2023</th><th>2024</th><th>2025</th><th>2026</th><th>2027</th><th>2028</th><th>2029</th><th>2030</th></tr>
<tr><td>Further enhance analysis and feasibility studies for the use of hydrogen in the city</td><td colspan="8">  </td></tr>
<tr><td>Development of an infrastructure enabling the use of hydrogen</td><td colspan="8">  </td></tr>
<tr><td>Implementation of pilot programs - purchase of 20 new hydrogen buses</td><td colspan="8">  </td></tr>
<tr><td>The use of purchased vehicles and the development of infrastructure to ensure transport connections between the most important attractions in the city</td><td colspan="8">  </td></tr>
</table>
</td></tr>
<tr><td>Action owner</td><td>Roads, Transport and Urban Maintenance Authority</td></tr>
<tr><td>Main stakeholders</td><td>Silesian Bus Consortium

City Promotion Department</td></tr>
<tr><td>Action benefits</td><td>• Reduction in greenhouse gas emissions of 2,475 tCO_2/year

Methodology:

A diesel bus emissivity of 1,570 gCO_2/km was assumed to determine emission reductions. In addition, the average annual distance travelled by buses in total was assumed to be 1,576,722 km.</td></tr>
<tr><td>Enabling policies, strategies and actions</td><td>• The action is linked to a project implemented by PKN Orlen in cooperation with the city of Wałbrzych related to the construction of a hydrogen filling station. Hydrogen from the planned station will be able to power public transport in the city.</td></tr>
<tr><td>Result indicators</td><td>• Number of implemented pilot projects in the field of hydrogen policy innovative production, storage, use and transport of hydrogen [pcs.]

• Purchase of 20 new hydrogen buses</td></tr>
<tr><td>Potential to develop inclusivity and improve social aspects</td><td>• Ensuring that the buses are procured considering universal design and accessibility needs of all passengers, and especially the elderly, people with young children, persons with disabilities, passengers with luggage, etc. (e.g., low-floor vehicles).

• Economic benefits from the increased tourism stem from better connectivity of the most important tourist sites in the city.</td></tr>
<tr><td>Potential for the implementation of innovative and smart technologies</td><td>• The buses fleet will contain Passenger Information System, e.-ticketing, as planned to be developed under action T1, T3.</td></tr>
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<table>
<tr><td>Mapping of risks, challenges</td><td colspan="3">• Wałbrzych is characterized by a hilly shape of the surface, which causes rapid depletion of electric bus batteries. Hydrogen can ensure effective implementation of zero-emission propulsion for part of the city's fleet and counteract the risk of low-efficiency use of low-emission buses in the city.</td></tr>
<tr><td rowspan="3">Costs</td><td>Pre-investment</td><td>Capital expenditure</td><td>OPEX</td></tr>
<tr><td>-</td><td>PLN 85,816,000
EUR 18,429,000</td><td>PLN 55,891,000
EUR 12,002,000</td></tr>
<tr><td colspan="3">Potential forms of savings</td></tr>
<tr><td colspan="3">• In addition to the social and environmental benefits, the development and diffusion of hydrogen technology may also have economic benefits in the future in the form of lower purchase costs for hydrogen than other carbon-intensive fuels.</td></tr>
<tr><td>Cost calculation</td><td colspan="3">Data source: Wałbrzych City Budget for 2022, Wałbrzych City Hall, Wałbrzych Municipality Status Report 2020 - Public Transport, Wloclawek and Konin online platform, GasHD, Foundation for the Promotion of Electric Vehicles.

Capital expenditure was determined based on planned investments in the 2022 Wałbrzych City Budget. It is planned to purchase 20 hydrogen-fueled buses, where the price per vehicle has been estimated at PLN 4,007,500. The total cost of purchasing 20 buses was estimated at PLN 80,150,000 (EUR 17,212,000).

In an order to strengthen and develop the hydrogen-based infrastructure, the construction of one hydrogen vehicle refueling station is recommended. The investment value ranged from 4 million to PLN 7 million, depending on the scope of the identified similar projects. The total estimated value of the concerned project is PLN 5,666,000 (EUR 1,217,000).

Proportionately for the current fleet of 56 buses, which covered a total of 4,414,821 vehicle kilometers in 2020, the new fleet of 20 buses is assumed to cover 1,576,722 vehicle kilometers. It is assumed that 8kg of hydrogen is burned for every 100 vehicle kilometers. In order for hydrogen-powered buses to travel the figure shown here, 126,138kg of hydrogen is needed. The average cost of hydrogen was set at 443 PLN out of a range of values from 320 PLN/kg to 560 PLN/kg. PLN 55,891,000 (EUR 12,002,000).

The estimation of GHG savings were done by using above annual average mileage and CO_2 emission factor for buses equals 1,570 gCO_2/km.</td></tr>
<tr><td>Financing mechanisms / source</td><td colspan="3">1. National Reconstruction Plan
• B2.1.1 Investment in hydrogen technology, hydrogen generation, storage and transport, grants,
• E1.1.1. Support for low-carbon economy, grants,
• E1.1.2. Zero and low-carbon public transport (buses), grants,
• E2.2.1. Investment in transport safety, grants,
• B3.4.1. Investments for comprehensive green transformation of cities, loans.</td></tr>
</table>

	2. *European Funds for Infrastructure, Climate, Environment Programme 2021-2027* • Objective 2.2 Promotion of renewable energy, o CODE 52. other types of RES (including geothermal energy), EUR 1.2 million for more developed regions, • Objective 2.8 Supporting sustainable multimodal urban mobility as part of the transition to a zero-carbon economy, o CODE 82 Clean urban transport fleet, o CODE 84. digitalization of urban transport, grants. 3. *Just Transition Fund* • investment in intelligent and sustainable local mobility, including the decarbonisation of local transport and its infrastructure, 4. *National Fund for Environmental Protection and Water Management, Energy Plus Programme, soft loans* 5. *Investment loans, green bonds,* 6. *City's own resources.*
Impact on the implementation of the sustainable development goals	

T5 Promotion of zero-emission transport

Timescale	Sector	Type of action	Objectives/ priorities
2023-2027		Capital investment	C5 - Supporting environmentally friendly, safe and integrated transport

Description and scale of action

As part of the action, it is planned to create local infrastructure for a network of electric vehicle charging stations in the vicinity of the areas of the most attractive tourist locations, including parking at: Zamek Książ, Palmiarnia, Aqua Zdrój, Stara Kopalnia, Rycerska Street, Przemysłowa Street, Sikorskiego Street, Młynarska Street, Sokołowskiego Street and Jana Pawła II Street. The project will consist of the comprehensive construction of 10 publicly accessible fast chargers for electric cars with a minimum power of DC 100 kW + AC 50 kW. Each charger should be able to charge four vehicles simultaneously. For this, the necessary technical documentation will be developed. Permits, opinions, decisions resulting from legal regulations will be obtained.

In addition to the fast-charging stations for electric vehicles, it is planned to build 20 smaller stationary battery charging points with a capacity of 22 kW for electric bicycles and scooters. These points would be placed near the planned new green bike shelters.

A potential and positive effect of introducing the above could be the further development of interest in the city by commercial transport-sharing providers using exclusively zero-emission modes of transport.

Background and justification of action

The city should support the development of local electromobility and encourage private investors to further projects supporting the development of zero-emission transport. Currently, there are electric vehicle charging stations in the city at a local shopping centre, a large-format supermarket or at the Szczawienko bus terminal. Disseminating the use of electric vehicles will contribute to the improvement of air quality in the city, reduction of CO_2 emissions and will improve the comfort and quality of life of the residents. There is currently a strong trend in Europe to support electromobility solutions. Many countries are choosing to introduce incentives for the purchase and ownership of electric vehicles in the form of tax credits or exemptions or even subsidies for their purchase. These legislative procedures are not possible to implement from the perspective of local authorities, but even in this case, the city can indirectly influence the development of this sector by creating favorable infrastructure or exemptions from charges in paid parking zones.

Schedule

Action implementation steps	2023	2024	2025	2026	2027	2028	2029	2030
Preparation of technical documentation, obtaining permits for the development of electric vehicle charging infrastructure								
Creation of a network of electric vehicle charging stations in the most attractive tourist areas								
Construction of charging points for bicycles and electric scooters								

Action owner	Road, Communication and City Maintenance Authority in Wałbrzych		
Main stakeholders	Transport and Road Traffic Department		
Action benefits	• Improving air quality in the city • Improving the comfort of using transport by residents		
Enabling policies, strategies and actions	• Plan for Sustainable Development of Public Transport for the Wałbrzych Commune (updated, 2021) • Low-Emission Economy Plan for 2014-2020 with a perspective until 2030 for 15 municipalities of the Wałbrzych Agglomeration • Related to the urbanistic objectives of the Territorial Just Transition Plan: "investments in smart and sustainable local mobility, including the purchase of low-emission and non-emission rolling stock for public transport (including rolling stock) and accompanying infrastructure, including charging points for public transport vehicles, bicycle paths, transfer points, revitalization of railway lines in order to restore the possibility of their functioning".		
Result indicators	• Number of electric vehicles charging stations built [pcs.] • Number of new charging points for bicycles and electric scooters in the city [pcs.]		
Potential to develop inclusivity and improve social aspects	• Generation of new employment opportunities. Ensuring the inclusiveness of the recruitment process and equal access for women to jobs. • Ensure that all fast-charging stations are planned by applying the principles of universal design and • Increased quality of life due to the positive effects of electric vehicles on the air quality and environment.		
Potential for the implementation of innovative and smart technologies	• Development and implementation of an application that manages and supports charging stations, enabling, inter alia, station monitoring, user management, tariff management and automatic invoicing, payments and settlements. City can potentially leverage agent-based modelling software to determine the best deployment strategy for the charging station.		
Mapping of risks, challenges	• The development of an electric vehicle charging system is a solution to counteract the risk of travelers using a single mode of transport in the city's varied terrain and unfavourable spatial layout. A lack of solutions in this area could result in intensified battery usage, resulting in more frequent repairs or even total demolition of the equipment.		
Costs	**Pre-investment**	**Capital expenditure**	**OPEX**
	-	PLN 3,897,000 EUR 836,000	PLN 201,000 EUR 43,000

	Potential forms of savings
	• Using charging infrastructure for electric vehicles will help to significantly reduce residents' travel costs by avoiding the need to purchase fuel or diesel.
Cost calculation	Data source: Wałbrzych City Hall, Metropolitan Bicycle Concept for the Górnośląsko-Zagłębiowska Metropolis, Electromobility Development in Poland - PWC, Nasielsk City Hall, Critical Elements of Vehicle-to-Grid (V2G) Economics - National Renewable Energy Laboratory.
	Capital expenditure represents the cost of building and installing 10 electric vehicle charging stations. The average estimated costs for the construction and installation of 1 charging station is approximately PLN 377,000 (with a range of values from PLN 336,000 to PLN 418,000). The total estimated cost is PLN 3,772,000 (EUR 810,000). In addition, the construction of 20 battery charging points for electric bicycles and scooters is assumed, where the average cost of one such point together with the installation of connections is estimated at PLN 6,250. The estimated cost of installing 20 such points is PLN 125,000 (EUR 26,800). Annual operating costs for maintenance, servicing and repair of the EV charging stations are estimated at around 5% of the total capital expenditure - PLN 188,600 (EUR 40,500). Annual operating costs for maintenance, preservation and servicing for charging points for electric bicycles and scooters were estimated at a level of around 10% of total capital expenditure - PLN 12,500 (EUR 2,700).
Financing mechanisms / source	1. *National Reconstruction Plan* • B3.4.1. Investments for comprehensive green transformation of cities, loans • E1.1.1. Support for low-carbon economy, grants, • E2.2.2. Digitisation of transport, grants, 2. *Programme European Funds for Infrastructure, Climate, Environment 2021-2027* • Objective 2.8 Supporting sustainable multimodal urban mobility as part of the transition towards a zero-carbon economy o CODE 81 Clean urban transport infrastructure, o CODE 84. Digitisation of urban transport. 3. *Just Transition Fund* • investment in intelligent and sustainable local mobility, including the decarbonisation of local transport and its infrastructure, 4. *Horizon Europe,* 5. *National Fund for Environmental Protection and Water Management - LIFE Programme,* 6. *Investment loans, green bonds,* 7. *City's own resources,*

Impact on the implementation of the sustainable development goals	

SECTOR: Waste

Action O1
Smart municipal waste management system

Action O2
Municipal system of selective waste collection and recycling

Action O3
Circular waste management

O1 Smart municipal waste management system

Timescale	Sector	Type of action	Objectives/ priorities
2023-2027		Capital investment	C11- Strengthening the ecological awareness of the inhabitants and improving the quality of selective waste collection

Description and scale of action	Design, delivery and commissioning of a comprehensive System of Individual Segregation of Municipal Waste for multi-family housing in the city. The investment will include purchase of mechanical devices for the collection of municipal waste (smart modules equipped with access control, measurement of filling, CCTV), installation of the devices in the city, commissioning of the devices and IT system, and provision of access and licenses to the relevant software. This program would initially be implemented in the largest housing estates in Wałbrzych, i.e., Piaskowa Góra and Podzamcze. These districts cover 42% of Wałbrzych's inhabitants. In the following years, the system could be expanded and will cover other districts with multi-family buildings. Households covered by the system will be equipped with a set of QR codes for each type of waste. A potential use of smart technology could be the implementation of a free mobile application that reminds people about waste collection deadlines, informs them of changes to the collection schedule, enable them to report irregularities by indicating their GPS location and attaching a photo. Users can make use of the information available in the application on Selective Municipal Waste Collection Centers, tips on correct municipal waste segregation. The functionality of the application could also be used by combining information on air quality data around Wałbrzych. With the implementation of the Individual Waste Segregation System, there is also the possibility of implementing other projects. One of them could be the campaign "Circular economy in Wałbrzych". The city of Wałbrzych could implement a campaign that aims to spread the idea of a circular economy. Its aim is to develop a long-term policy and programmes involving the whole community, including residents, NGOs, business and administration. The idea is to gradually reduce the amount of waste produced, including product reuse, recycling or composting.
Background and justification of action	In the city, there is a need to increase the level of selective collection and segregation of waste "at the source", as well as the awareness of residents in the field of segregation and selective collection of waste. Residents find it difficult to keep up with the constantly changing guidelines on waste segregation. Therefore, there is a need to create systems of incentives / promotion / education of residents in the field of segregation, use of separate collection points and recycling of waste. Local conditions and the lack of communal plots in single-family housing, where private real estate predominates, make it difficult to place containers for selective municipal waste collection in new locations. Nevertheless, new locations are still being selected to set up additional containers for separate waste collection. In the city, the existing selective collection of municipal waste is still being retrofitted with additional containers. Currently, the biggest challenge is the introduced obligation to segregate all 5 fractions of waste.

<table>
<tr><td>Schedule</td><td>
<table>
<tr><th>Action implementation steps</th><th>2023</th><th>2024</th><th>2025</th><th>2026</th><th>2027</th><th>2028</th><th>2029</th><th>2030</th></tr>
<tr><td>Designing the System of Individual Segregation of Municipal Waste</td><td colspan="8"></td></tr>
<tr><td>Implementation of a pilot program in Piaskowa Góra and Podzamcze districts</td><td colspan="8"></td></tr>
<tr><td>Implementation of a free mobile application that facilitates the segregation and collection of waste</td><td colspan="8"></td></tr>
<tr><td>Implementation of the assumptions of the campaign "Circular economy in Wałbrzych"</td><td colspan="8"></td></tr>
</table>
</td></tr>
<tr><td>Action owner</td><td>Environmental Protection Department</td></tr>
<tr><td>Main stakeholders</td><td>Municipal Utilities Authority
Education and Social Affairs Department</td></tr>
<tr><td>Action benefits</td><td>• Improving the selective collection of municipal waste and the level of waste recycling
• Increasing resource efficiency by reusing and recycling certain items
• Increasing the awareness of the residents</td></tr>
<tr><td>Enabling policies, strategies and actions</td><td>• Voivodship Waste Management Plan for the Lower Silesian Voivodship
• Environmental Protection Program for the city of Wałbrzych - a city with poviat rights for 2016-2019, considering the 2023 perspective
• Municipal Climate Change Adaptation Plan for Wałbrzych - related to the urbanistic objectives of the Territorial Just Transition Plan: "investments in strengthening the circular economy, including by preventing and reducing waste, resource efficiency, reuse, repair and recycling (without landfill reclamation, unless post-mining)".</td></tr>
<tr><td>Result indicators</td><td>• Covering 42% of Wałbrzych residents with the Individual Municipal Waste Segregation System.</td></tr>
<tr><td>Potential to develop inclusivity and improve social aspects</td><td>• Universal design should be applied for the locations of systems for individual segregation of municipal waste.
• Consider implementation of a system of incentives encouraging waste segregation (e.g., provision of tickets to cultural events in exchange for the appropriate amount of adequately disposed waste).
• Raised awareness of the city population through the campaigns delivered via application for waste segregation.
• Potential for the reduction of illegal dumping, improving hygienic conditions in the city.</td></tr>
</table>

<table>
<tr><td>Potential for the implementation of innovative and smart technologies</td><td>

Implementation of a free application for smartphones, which will remind about the date of waste collection, inform about the change in the schedule of their collection, enable reporting of irregularities by indicating the GPS location. Users could use the information available in the application on Selective Collection of Municipal Waste Points, tips on the proper segregation of municipal waste, as well as check data on air quality in Wałbrzych.
A sensor network (LoraWan can be used) can be built to monitor container occupancy remotely. Thus, the discharge frequency for each container and the route optimizations of the waste collection trucks are revealed on this occasion.
In a further step, introduction of an innovative System of Individual Waste Segregation, with the use of smart containers "Electronic Counter of Municipal Waste". Residents could open them with stickers with individual codes. The system could enable the correct settlement of fees and waste segregation declarations.
Potential to creation in the future of a system of rewards for pro-ecological attitudes in the field of waste recycling. In this way, a system of competitions and awards for residents can be developed, e.g., in the form of an interactive website, with dynamic “Top20 Greener residents” who recycle the most in the city.

</td></tr>
<tr><td>Mapping of risks, challenges</td><td>

There is a significant risk in the city related to low awareness and social activity of residents and the resulting problems and inappropriate conduct, such as: low level of separate waste collection, burning waste in private furnaces to heat the building, lack of post-industrial waste management on private land, etc. The Individual Waste Segregation System will be one of the tools to counteract these negative factors.

</td></tr>
<tr><td>Costs</td><td>
<table>
<tr><th>Pre-investment</th><th>Capital expenditure</th><th>OPEX</th></tr>
<tr><td>-</td><td>PLN 162,105,000
EUR 34,812,000</td><td>PLN 520,000
EUR 112,200</td></tr>
<tr><td colspan="3">Potential forms of savings</td></tr>
<tr><td colspan="3">

The implementation of the system in the city will optimise the costs associated with the collection, processing and segregation of municipal waste.

</td></tr>
</table>
</td></tr>
<tr><td>Cost calculation</td><td>Data source: Public Procurement of the City Hall in Zamość, Local Data Bank, City Hall in Wałbrzych, InVałbrzych, Procurement platform of the Housing Management Company in Słupsk.

The capital expenditure associated with the design, supply and commissioning of a comprehensive Municipal Waste Segregation System for multi-family housing in Wałbrzych was determined based on the costs of implementing a pilot programme of the same scope in Zamość, covering 758 flats. Assuming that 1 flat equal 1 household, the programme would cover 42% of households in Wałbrzych (21,326), the proportionate cost is estimated at PLN 162,105,000 (EUR 34,812,000).</td></tr>
</table>

	The operating costs are estimated on the basis of the costs of operation of the Municipal Individual Waste Segregation System in Zamość and are related to: training, expenditure on salaries and derivatives of 5 employees involved in the operation of the waste management system, together with other current expenditure in the performance of their duties, including: purchase of consumables, office supplies, equipment, energy charges, telecommunication services, etc. The estimated annual operating cost will be approximately PLN 520,000 (EUR 112,200).
Financing mechanisms / source	1. *National Reconstruction Plan* • B3.4.1. Investments for comprehensive green transformation of cities, loans, • C2.1.1. E-public services, IT solutions to improve the functioning of government and economic sectors and breakthrough technologies in the public sector, economy and society, grants. 2. *European Funds for Infrastructure, Climate, Environment Programme 2021-2027* • Objective 2.6. Support the transformation towards a closed and resource efficient economy, o KOD 67. Household waste management: waste prevention, minimisation, separation, reuse, recycling, grants, o KOD 70. management of industrial and commercial waste: residual and hazardous waste, grants. 3. *City's own resources.*
Impact on the implementation of the sustainable development goals	

O2 Municipal system of selective waste collection and recycling

Timescale	Sector	Type of action	Objectives/ priorities
2023-2026		Capital investment	C11 - Strengthening the ecological awareness of the inhabitants and improving the quality of selective waste collection

Description and scale of action

Within the city there is a need to install about 600 new waste shelters. The newly built shelters should be of an appropriate size to enable selective waste collection by providing space for separate containers for: paper, glass, metal, plastics, packaging waste, multi-material waste and bio-waste. Sheds should be planted with climbing plants. Thanks to a natural barrier that would improve the visual aspect, add an element of natural vegetation in the urban space, they will provide a natural barrier against the spread of waste and reduce the odour of this type of facility. In addition, in the heritage area of the city, underground selective waste collection tanks integrated into the individual municipal waste collection system should be introduced.

An additional solution would be the creation of "Repair Café" points, which would function as socio-economic enterprise under the control and coordination of the city. This action could be centralised for WEEE - Waste Electrical and Electronic Equipment, which could be used exclusively for the city (daily appliances - fridges, washing machines, monitors etc.). This enterprise could employ and train long-term unemployed people in WEEE repair and dismantling. The project would involve the integration and education of the local community through free, mutual repair of unusable devices. Repairing damaged items extends their service life, restores the possibility of re-use and prevents throwing away and overproducing waste. The project could be implemented in educational institutions. In addition, by combining the issues of recycling and the concept of "Repair Café", employees of Municipal Utilities Authority could conduct environmental workshops in educational institutions on the basic principles of waste segregation and informing about the number of raw materials actually recovered in recycling processes.

A solution that would help to eliminate the problem of uncollected bulky waste could be the electric waste collection vehicles. Initially, the city would purchase 4 specially made cars to cover the designated route through the city, on selected dates and collecting the following waste:

1. Small waste electrical and electronic equipment,
2. Chemicals (solvents, used or expired car engine oils, detergents, adhesives and resins) in packaging allowing their identification, e.g., by labelling,
3. Adhesives and adhesive packages (in packaging that allows identification, e.g., by labelling),
4. Plant protection products (in packaging allowing their identification, e.g., by labelling),
5. Fluorescent lamps, fluorescent tubes, energy-saving lamps,
6. Edible oils and fats (in packaging allowing them to be identified, e.g., by a label),

	7. Paints, paint packaging (in packaging allowing its identification, e.g., by labelling), 8. Inks, printer toners, 9. Mercury thermometers, 10. Used batteries and accumulators.
Background and justification of action	Currently, 10 green bin shelters have been built in the city, therefore there is a further need to develop waste collection infrastructure. Due to the specific characteristics of the city of Wałbrzych, the next construction of this type of infrastructure is planned on the main thoroughfares connecting individual districts. Waste collected from the city of Wałbrzych is transported to the municipal installation at 43 Beethovena Street in Wałbrzych, where it is sorted into fractions. The installation can process up to 40,000 tons/year of mixed municipal waste and 10,000 tons/year of waste from selective collection. After the sorting process, the waste is shifted in the drums and two fractions are formed: compost – sold (used iter alia to level the top layer of landfills) and stabilizer – transferred to authorized external installations. The process enables the reduction of the amount of waste intended for final disposal through landfilling by approximately 60%. As part of the investment, a plant for biological treatment of green waste was also built in the city in the amount of 2,000 tons/year. The functioning of the Municipal Installation in the city creates the possibility of processing waste and bio-waste from selective collection.
Schedule	**Action implementation steps** | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030
	Installation of approximately 600 new green bin shelters (including underground storage tanks)
	Creation of "Repair Café" points
	Purchase of Environmentally Friendly Waste Collection Vehicles
Action owner	Environmental Protection Department
Main stakeholders	Municipal Utilities Authority
Action benefits	• Improvement of local waste management along with improvement of selective collection of municipal waste. • Reducing the occurrence of the phenomenon of illegal creation of wild dumps. • Reduce environmental pollution through properly organised collection of household hazardous waste by providing special vehicles to collect this waste.

<table>
<tr><td>Enabling policies, strategies and actions</td><td>

Voivodship Waste Management Plan for the Lower Silesian Voivodship
Environmental Protection Program for the city of Wałbrzych - a city with poviat rights for 2016-2019, considering the 2023 perspective
Municipal Climate Change Adaptation Plan for Wałbrzych - related to the urbanistic objectives of the Territorial Just Transition Plan: "investments in strengthening the circular economy, including by preventing and reducing waste, resource efficiency, reuse, repair and recycling (without landfill reclamation, unless post-mining)".

</td></tr>
<tr><td>Result indicators</td><td>

Number of new green bin shelters installed [pcs.]
Number of created "Repair Café" points in the city [pcs.]
Number of Waste Collection Vehicles purchased [pcs.]

</td></tr>
<tr><td>Potential to develop inclusivity and improve social aspects</td><td>

Generation of new employment opportunities. Ensuring the inclusiveness of the recruitment process and equal access for women.
Universal design should be applied for the locations of waste collection points, to allow accessibility to all citizens.
Potential for capacity building and skill learning through the activities of the Repair Café, especially for the economically vulnerable households.

</td></tr>
<tr><td>Potential for the implementation of innovative and smart technologies</td><td>

Development of a free city application for residents, which would include information about the schedule of trips of Waste Collection Vehicles, information about the actions of "Repair Café" points in the city.

</td></tr>
<tr><td>Mapping of risks, challenges</td><td>

In Wałbrzych, there is a significant risk related to the low awareness and social activity of residents resulting in problems and improper conduct, such as: creating illegal landfills, burning waste in private furnaces to heat the building, illegal mining and the lack of management of post-industrial waste from private areas, etc. The solutions proposed within the measure will allow to minimize the causative factors of existing challenges in the city.

</td></tr>
<tr><td>Costs</td><td>
<table>
<tr><th>Pre-investment</th><th>Capital expenditure</th><th>OPEX</th></tr>
<tr><td>-</td><td>PLN 22,380,000
EUR 4,806,000</td><td>PLN 2,300,000
EUR 493,900</td></tr>
<tr><th colspan="3">Potential forms of savings</th></tr>
<tr><td colspan="3">

The development of an infrastructure of waste shelters with appropriate waste containers will increase the accessibility for residents and enable them to segregate their municipal waste, which will ultimately avoid the costs of subsequent segregation and potentially translate into lower waste collection bills for individual households.

</td></tr>
</table>
</td></tr>
<tr><td>Cost calculation</td><td>Data source: Wałbrzych City Hall, InVałbrzych, Procurement platform of the Housing Management Company in Słupsk.</td></tr>
</table>

	The capital expenditure represents the cost of installing green trash shelters within the city. The estimated cost of building one waste shelter with green infrastructure is approximately PLN 34,600. The city plans to install 600 such shelters - PLN 20,780,000 (EUR 4,462,000). The purchase and appropriate adaptation of 1 problematic waste collection vehicle has been estimated at PLN 400,000. Assuming the purchase of 4 such vehicles, the cost will be PLN 1,600,000 (EUR 343,600). Annual operating costs were estimated on the basis of current costs associated with the maintenance of municipal facilities in the city and amount to PLN 2,300,000 (EUR 493,900).
Financing mechanisms / source	1. *National Reconstruction Plan* • B3.4.1. Investments for comprehensive green transformation of cities, loans, 2. *European Funds for Infrastructure, Climate, Environment Programme 2021-2027* • Objective 2.6. Support the transformation towards a closed and resource efficient economy, o KOD 67. Household waste management: waste prevention, minimisation, separation, reuse, recycling, grants, o KOD 70. management of industrial and commercial waste: residual and hazardous waste, grants. 3. *National Fund for Environmental Protection and Water Management* 4. *Provincial Fund for Environmental Protection and Water Management* 5. *City's own resources.*
Impact on the implementation of the sustainable development goals	

O3 Circular waste management

Timescale	Sector	Type of action	Objectives/ priorities
2023-2026		Capital investment	C11 - Strengthening the ecological awareness of the inhabitants and improving the quality of selective waste collection

Description and scale of action

This action will include completing the modernisation of the waste management infrastructure in Wałbrzych by finalising the construction of a holistic circular waste management system.

This action will support the previously proposed solutions, as well as the city's other plans related to improving the functioning of the municipal waste management system, in an efficient and organised manner.

This action will focus on:

1. The construction of halls and a biofilter system to ensure the encapsulation of the biological treatment of municipal waste, together with the purchase of appropriate equipment, i.e., vehicles, containers and all the necessary equipment for the operation of such a facility,
2. Redevelopment of the indicated area in order to create a transport base (parking places for vehicles: rubbish trucks, so-called hook-up trucks, loaders, trucks,
3. Construction of offices and social space to support the aforementioned facilities.

The investments in the construction of waste treatment facilities will include: the construction of seven modern concrete reactors for the biological treatment of waste together with technical infrastructure, including one facility for the cleaning of glass packaging and for the treatment of bulky waste. In addition, odour-eliminating biofilters, odour barriers, a rainwater retention tank, an on-site treatment plant for treating leachate discharged into the municipal sewer system, a process air intake of the sorting hall for air filters, and a fire-fighting installation for sorting hall will be installed.

The indicated initiatives will allow reduction of odour and fume emissions, as well as improves the recovery of recycled materials and raw materials. Locating the above-mentioned facilities outside inhabited areas will significantly improve housing conditions and provides potential for the development of unused degraded and post-mining areas.

Background and justification of action

In 2020, the total amount of municipal waste collected from property owners from the Wałbrzych municipality and collected at the PSZOK was over 35 thousand tonnes. The largest share of the collected municipal waste is non-segregated (mixed) municipal waste - over 23 thousand tonnes (about 65% of all collected waste). For this reason, there is a need to develop a proper municipal waste management system in the city.

A circular economy should operate in such a way that the use value of the raw materials, and other products concerned is preserved as long as possible, thereby minimising the generation of waste. Raw materials should be recovered from the

	waste that will inevitably be generated. The provisions of the circular waste management should operate at every stage of a product's life cycle. However, the greatest impact of the city is on the final stage - the collection and management of waste.
Schedule	**Action implementation steps** — 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 Appropriate site selection and land development for new facilities Comprehensive construction of new halls along with the purchase of appropriate plant, equipment, vehicles and containers Construction of offices for employees of the designated facilities
Action owner	Environmental and Climate Department
Main stakeholders	Municipal Utilities Authority Education and Social Affairs Department
Action benefits	• Improving the selective collection of municipal waste and the level of waste recycling • Increasing resource efficiency by reusing and recycling certain items • Increasing the awareness of the residents
Enabling policies, strategies and actions	• Voivodship Waste Management Plan for the Lower Silesian Voivodship • Environmental Protection Program for the city of Wałbrzych - a city with poviat rights for 2016-2019, considering the 2023 perspective • Municipal Climate Change Adaptation Plan for Wałbrzych - related to the urbanistic objectives of the Territorial Just Transition Plan: "investments in strengthening the circular economy, including by preventing and reducing waste, resource efficiency, reuse, repair and recycling (without landfill reclamation, unless post-mining)".
Result indicators	• Increase in the % number of recycled wastes per year.
Potential to develop inclusivity and improve social aspects	• Generating new employment opportunities. Ensure inclusivity of the recruitment process and equal access for women. • Apply universal design to planned development sites to enable accessibility for all citizens.
Potential for the implementation of innovative and smart technologies	• Low carbon emissions with route optimization for waste collection trucks. • Bio-energy production in selective waste collection centers. • Looking forward, the development of digital building permits and building digital passports could support the city in strenghtening circular economy.

<table>
<tr><td>Mapping of risks, challenges</td><td>

- There is a risk of a high odor around waste treatment and disposal facilities. This risk can be minimized by building closed facilities and waste processing halls.

</td></tr>
<tr><td>Costs</td><td>

<table>
<tr><th>Pre-investment</th><th>Capital expenditure</th><th>OPEX</th></tr>
<tr><td>-</td><td>PLN 60,000,000
EUR 12,885,000</td><td>PLN 1,500,000
EUR 322,100</td></tr>
<tr><th colspan="3">Potential forms of savings</th></tr>
<tr><td colspan="3">

- The implementation of the system in the city will optimise the costs associated with the collection, processing and segregation of municipal waste.

</td></tr>
</table>

</td></tr>
<tr><td>Cost calculation</td><td>

Data source: Wałbrzych City Hall, InValbrzych, city of Wałbrzych budget for 2022.

Capital expenditure will involve the cost of building halls, implementing biofilter systems, purchasing appropriate equipment to support the process of biological processing of municipal waste, purchasing electric vehicles and appropriate containers, appropriate redevelopment and adaptation of land for new development. The Wałbrzych City Council have indicated the costs of the planned investment - PLN 60,000,000 (EUR 12,885,000).

The annual operating expenses of the new facilities have been estimated on the basis of waste management costs at the municipal sorting and storage facilities. These costs amount to approximately 3% of capital expenditure - PLN 1,500,000 (EUR 322,100).

</td></tr>
<tr><td>Financing mechanisms / source</td><td>

1. *National Reconstruction Plan*

- B3.4.1. Investments for comprehensive green transformation of cities, loans,

2. *European Funds for Infrastructure, Climate, Environment Programme 2021-2027*

- Objective 2.6. Support the transformation towards a closed and resource efficient economy,
  - KOD 67. Household waste management: waste prevention, minimisation, separation, reuse, recycling, grants,
  - KOD 70. management of industrial and commercial waste: residual and hazardous waste, grants.

3. *City's own resources.*

</td></tr>
<tr><td>Impact on the implementation of the sustainable development goals</td><td>

</td></tr>
</table>

SECTOR: LAND USE

Action U1 Further development of pocket parks in the city and protection and restoration of valuable land in the city

Action U2 Revitalization and decontamination of degraded areas

U1 Further development of pocket parks in the city and protection and restoration of valuable land in the city

Time horizon	Sector	Action type	Objectives/priorities
2023-2028		Capital investment	C8 - Actions to adapt and increase the city's resilience to climate change

Description and scale of action	Creation of pocket parks with associated infrastructure. Tasks within this action will include preparation of project documentation and material implementation, including construction of park paths, lighting, monitoring, ecological playgrounds for children, places for street workout, places for nesting boxes and hives for bees, elements of small architecture (benches, waste bins, bicycle stands) and development of honey-giving meadows which will support biodiversity of the local ecosystem. In addition, new plantings will be made (trees, shrubs, melliferous plants, perennials). In the first step it is assumed that a green area development plan will be developed with the use of blue-green infrastructure. The implementation of the plan is essential in order to efficiently and properly conduct the process of green space development in the city. The plan should consider the networks of greenery and water management, with particular emphasis on plans for the development of bicycle paths and tourism. At the same time, it may consider the guidelines for organizing tenders and conducting investments related to the creation and maintenance of new green areas in the city The city plans to create around 180 pocket parks, together with the demolition of old buildings that risk collapse and the redevelopment of sites in their place. The estimated area of new green space will be a minimum of 18 ha. There will be a restoration of biodiversity in these areas, it is expected that about 30% of the area will be allocated to nature conservation. Nature-based solutions such as green pavements, flower meadows and rain gardens can be implemented. 23 locations have been identified in the city where the first step is to build and develop pocket parks.

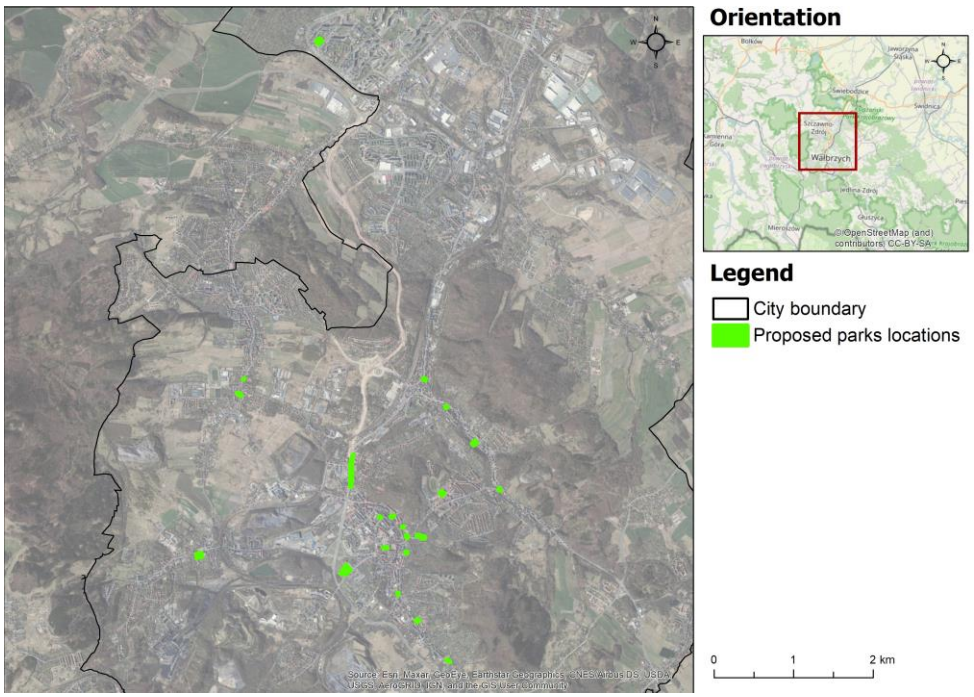

Figure 12 Proposed location of 23 pocket parks in the city

The action will support the demolition of some buildings and the redevelopment of green areas in their place. As part of the initial plans, 180 buildings have been selected for demolition and studies are still being conducted for a further 100 buildings.

It is important to develop a sustainable rainwater management system using permeable surfaces, buffer vegetation belts (as part of pocket parks and street green areas), or the use of rainwater retention solutions. For this purpose, there are plans to create new retention reservoir at a designated location, characterised by frequent collection of larger amounts of rainwater that cause flooding or on brownfield sites that cannot be developed in any other way.

Background and justification for action

The aim of this action will be to protect the green areas in the city and to create unique places to preserve biodiversity, improve the city's aeration and water retention in city areas. As a result of the implementation of the investment, the quality of the urban environment and life of the residents will improve in line with an increase in and the public awareness of environmental protection will increase. All areas covered by the project will be an open facility, accessible to everyone free of charge and adapted to the needs of disabled people; they will foster social integration, relaxation and recreation.

The city has a large potential for green areas and post-industrial areas, which create potential for the creation of pocket parks and the development of existing ones. The city is implementing projects in this area, an example is the project "Green Yards - Pocket Parks in the old districts of Wałbrzych", under which four pocket parks were built.

In the future, the city also envisages to restore the old reservoirs at Kania/Zachodnia, Piastów Śląskich, Bystrzycka/Noworudzka, Osiedleńców, Zagórzańska, Beethovena streets. As part of the implementation of the action,

<table>
<tr><td></td><td colspan="9">rehabilitation of water reservoirs and post-mining settlements along with their adaptation for recreational and tourist purposes should be implemented.</td></tr>
<tr><td>Schedule</td><td>Action implementation steps</td><td>2023</td><td>2024</td><td>2025</td><td>2026</td><td>2027</td><td>2028</td><td>2029</td><td>2030</td></tr>
<tr><td></td><td>Preparation of a plan for the development of green areas with the use of blue and green infrastructure</td><td colspan="8"></td></tr>
<tr><td></td><td>Realization demolition of some buildings in order to locate pocket parks</td><td colspan="8"></td></tr>
<tr><td></td><td>Construction of pocket parks</td><td colspan="8"></td></tr>
<tr><td></td><td>Creation of a retention</td><td colspan="8"></td></tr>
<tr><td>Action owner</td><td colspan="9">Environment and Climate Department</td></tr>
<tr><td>Main stakeholders</td><td colspan="9">Revitalization and Spatial Planning Department
Urban planner
Municipal Building Management
Wałbrzych Forest Inspectorate
Housing cooperatives, housing communities, private individuals, building managers
Private sector</td></tr>
<tr><td>Action Benefits</td><td colspan="9">• Reduction of greenhouse gas emissions 45 tCO_2 per year
Methodology:
A carbon sequestration rate for parks of 1.95 $kgCO_2/m^2$/year was used to estimate reductions.
• Increasing green areas and increasing biodiversity in the city
• Management and reuse of rainwater
Increasing the level of water retention
• Improving the comfort and quality of life of residents
• Improving the spatial, aesthetic and tourist attractiveness of the city</td></tr>
<tr><td>Related policies, strategies, actions</td><td colspan="9">• Environmental Protection Program for the city of Wałbrzych - a city with poviat rights for 2016-2019, considering the 2023 perspective
• Municipal Revitalization Program of the city of Wałbrzych for the years 2016-2025
• Study of the city's spatial conditions and directions
• Municipal Climate Change Adaptation Plan for Wałbrzych</td></tr>
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- Related to the spatial objectives of the Territorial Just Transition Plan: "reclamation, renaturalization, remediation, decontamination and development of areas, post-mining, and post-industrial buildings by restoring biodiversity and giving them new economic, social, tourist and recreational functions".

</td></tr>
<tr><td>Result indicators</td><td>

- Number of new pocket parks implemented [pcs.]
- Number of built / reconstructed storage reservoirs in the city [pcs.]

</td></tr>
<tr><td>Potential for the development of inclusivity and gender equality</td><td>

- Principles of universal design should be applied in the design process, in order to enable accessibility of the green areas to all citizens, but especially parents with children, people with disabilities, etc.
- Design of green areas considering safety of citizens and especially potentially vulnerable groups (e.g., women, minors, minorities, etc.), in terms of illumination, etc.
- The action of increasing green spaces will have a positive impact on the living conditions of all residents.

</td></tr>
<tr><td>Potential to implement innovative and smart technologies</td><td>

- Improvement city GIS system for urban planning and land use.
- Implementation of smart sensors for qualitative / quantitative monitoring of biologically active surfaces (retention, humidity, temperature, gas and dust absorption, biodiversity).
- Implementation of a coherent system of surface water management or the storage capacity of rainwater during heavy rainfall / performance of hydraulic modeling.
- Establishment of led screens or kiosks to access basic citizenship services, such as purchasing tickets to tourist attractions, maps and information about historic and recreational parts of the city.

</td></tr>
<tr><td>Mapping risks, challenges</td><td>

- The action responds to the city's water management challenges, such as the occurrence of local flooding or drought. Increasing the area of green areas also reduces the risk associated with heat waves and drought. The action also reduces the effect of the Urban Heat Island, which was identified in Wałbrzych in areas with a significant share of urbanized areas.

</td></tr>
<tr><td>Costs</td><td>
<table>
<tr><th>Pre-investment</th><th>Capital expenditure</th><th>OPEX</th></tr>
<tr><td>PLN 50,000
EUR 10,700</td><td>PLN 10,862,000
EUR 2,332,000</td><td>PLN 85,700
EUR 18,400</td></tr>
<tr><td colspan="3">Potential forms of savings</td></tr>
<tr><td colspan="3">

- The construction of pocket parks will solve the problem of incurring costs associated with inefficient water retention in the city, and retention basins will avoid the cost of using water to water urban vegetation.

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<tr><td></td><td>Data source: Wałbrzych City Hall</td></tr>
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Cost calculation	Pre-investment costs represent the expenditure associated with the preparation of a plan for the development of green spaces using blue-green infrastructure together with guidelines for public procurement in the green sector - PLN 50,000 (EUR 10,700). Capital expenditure represents the cost of building pocket parks in the 23 locations indicated. Based on the investments already made by the city in the construction of pocket parks in Wałbrzych, the capital expenditure associated with the implementation of such an investment was estimated. The cost of building 1 ha of pocket park was estimated at PLN 4,394,000. Based on the indicated locations, it was assumed that each of the indicated 23 pocket parks will have an area of no more than 1,000 m^2 - PLN 10,107,000 (EUR 2,170,000). In addition, the action envisages the construction of a naturalistic retention reservoir that will retain and treat water from surface runoff. Aquatic vegetation will be an element of this reservoir, which will give it a natural character, intensify the development of biodiversity and support the water filtration process. The capital expenditure for this project has been estimated based on completed investments of the similar character. The estimated cost of building one retention reservoir with an area of 1 ha is PLN 755,000 (EUR 162,000). Operating expenses represent the costs of maintaining the greenery of 23 new pocket parks (including the costs of cleaning, vegetation care, mowing and maintenance of facilities in the park area). The costs were estimated on the basis of park maintenance costs included in the Warsaw City Budget. The unit cost per m^2 of park maintenance was estimated at 3.73 PLN. While the total annual operating expenses were estimated at PLN 85,700 (EUR 18,400).
Financing mechanisms / source	1. *Programme European Funds for Infrastructure, Climate, Environment 2021-2027,* • Objective 2.7 Strengthen the protection and conservation of nature, biodiversity, including in urban areas, and reduce pollution of all kinds, o CODE 78. protection, regeneration, sustainable use of Natura 2000 sites, o CODE 79. Protection of nature and biodiversity, natural heritage and resources, blue-green infrastructure. 2. *Just Transition Fund* • revitalisation and decontamination of degraded areas, restoration of functions to post-mining areas, and change of land use, 3. *National Fund for Environmental Protection and Water Management,* 4. *City's own resources.*
Impact on the implementation of the sustainable development goals	

U2 Revitalization and decontamination of degraded areas

Time horizon	Sector	Action type	Objectives/priorities
2023-2030		Capital investment	C7 - Improving spatial order along with land protection through constant revitalization and decontamination of degraded areas

Description and scale of action	The action will include initiatives aimed at changing the land use and revitalization of areas in the city. Revitalisation of Park Sobieski is planned under this action. This park in Wałbrzych is a forest of 32 ha in the city centre. This investment will create an even more friendly place for active recreation in the city, providing a wide range of recreational opportunities for different age groups. It involves the reconstruction of existing alleys, a rainwater drainage network, the construction of pergolas, park fountains, LED lighting and the installation of small architecture. The action will be a road map and a reference point for further investments - an urban revitalisation good practice catalogue will be created as part of the action. The solutions developed will be available for use in future revitalisations, e.g., of the Municipal Stadium, Sybiraków Park, Sobięcin district, the area around Beethoven Street, the Old Mine building and the New Town area.
Background and justification for action	Implementation of future city actions will require resolution of post-mining land ownership issues. In the future the city should set up a special fund to buy back post-industrial buildings that threaten the safety of residents and the environment. Most of these buildings are owned by the State and should be bought back for redevelopment and revitalisation (e.g., the building at 5 Matejki Street), In the future, the city should also focus on the restoration of historic buildings (e.g., the historic building in the Bialy Kamien district). Revitalization of buildings includes activities aimed at improving housing conditions and increasing spatial attractiveness, providing new functions, deep thermal modernization in order to increase thermal and energy efficiency, increasing the accessibility of buildings for people with disabilities. Revitalisation should be understood as the process of taking degraded areas of a city out of crisis and adding new functions to them (through holistic actions, i.e., interrelated activities covering social and economic, spatial-functional, technical or environmental issues). Due to its post-industrial nature, the city has many degraded or undeveloped and decaying post-mining areas, which include, among others, buildings, tanks, settling tanks or mine heaps. As a result of mining exploitation and subsequent liquidation of the mining industry, negative phenomena accumulated, manifested in the devastation of post-industrial areas, environmental pollution and decapitalization of buildings. The total area of the degraded post-industrial areas of Wałbrzych is 4,681,646 m^2 (approx. 5.5% of the city). There is a need for reclamation and decontamination of mining heaps in the city. The city's existing conditions create a number of opportunities for projects to revitalise and restore the functionality of these areas, as well as to create new green and community-friendly areas.

Schedule	**Action implementation steps**	2023 2024 2025 2026 2027 2028 2029 2030
	Preparation of a development plan and revitalisation concept for Sobieski Park	
	Selection of contractor for park redevelopment	
	Complex revitalisation of Sobieski Park	
	Creating a catalogue of urban revitalisation good practices	
	Undertake initiatives and constant monitoring of the city to identify areas in need of further revitalisation	
Action owner	Revitalization and Spatial Planning Department	
Main stakeholders	Real Estate Management Department Investment Department, Municipal Building Administration, Municipal Building Management	
Action Benefits	• Increase the area of green spaces, number of trees and shrubs in the city. • Increasing the number of recreational areas for residents and tourists, improving the quality of life in the city. •	
Related policies, strategies, actions	• Municipal Revitalization Program of the city of Wałbrzych for the years 2016-2025 • Study of the city's spatial conditions and directions • Environmental Protection Program for the city of Wałbrzych - a city with poviat rights for 2016-2019, considering the 2023 perspective • Related to planned actions submitted under the Just Transformation Fund: "Giving social and economic functions to degraded, post-mining areas around Beethovena Street in Wałbrzych "and" Comprehensive revitalization of the post-mining district of Wałbrzych - Sobięcin - flagship solutions for the circular economy and energy-saving construction in the Wałbrzych subregion" • Related to the spatial objectives of the Territorial Just Transition Plan: "reclamation, renaturalization, remediation, decontamination and development of areas, post-mining, post-mining and post-industrial buildings by restoring biodiversity and giving them new economic, social, tourist and recreational functions".	

<table>
<tr><td>Result indicators</td><td>

Creation of a good practices catalogue for the revitalization of urban space.
Area of revitalized space of Sobieski Park [ha]

</td></tr>
<tr><td>Potential for the development of inclusivity and gender equality</td><td>

Principles of universal design should be applied in the design process, in order to enable accessibility of the revitalized areas and buildings to all citizens, but especially parents with children, people with disabilities, etc.
Design of revitalized areas considering safety of citizens and especially potentially vulnerable groups (e.g., women, minors, minorities, etc.), in terms of illumination, CCTV, etc.
Positive impact on the living conditions and wellbeing of all residents, due to revitalized green areas.

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<tr><td>Potential to implement innovative and smart technologies</td><td>

Improvement city GIS system for urban planning and land use.
Including in city applications (e.g. GIS platform for residents https://gis.walbrzych.pl/) a function enabling citizens to explore initiatives for the renovation of green areas

</td></tr>
<tr><td>Mapping risks, challenges</td><td>

Due to the city's history, there are many degraded post-mining areas that create hazards and are often characterised by post-industrial pollution. This action aims to restore functionality to deteriorating and unused areas.

</td></tr>
<tr><td>Costs</td><td>
<table>
<tr><th>Pre-investment</th><th>Capital expenditure</th><th>OPEX</th></tr>
<tr><td>PLN 427,400
EUR 91,800</td><td>PLN 138,000,000
EUR 29,640,000</td><td>PLN 1,193,000
EUR 256,000</td></tr>
<tr><td colspan="3">Potential forms of savings</td></tr>
<tr><td colspan="3">

Increasing the city's tourist attractiveness will result in more funds coming into the budget due to the influx of tourists to the city

</td></tr>
</table>
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<tr><td>Cost calculation</td><td>
Data source: Wałbrzych City Hall, Miechów Municipality and City Hall, Nowy Sącz City Hall, Kraków Civic Budget, EU Grants Map, CSO Local Data Bank.

Pre-investment costs will be expenses related to the development of multi-discipline project documentation, obtaining relevant opinions and permits, and have been estimated on the basis of similar investments carried out in Kraków and Otwock – PLN 227,400 PLN (EUR 48,800).

Capital expenditure will represent the cost of revitalising 32 ha of the Sobieski Park area in Wałbrzych. The estimated average cost of revitalisation of 1 ha has been estimated on the basis of similar investments (with a value range of PLN 3.55 million to PLN 5.07 million) and amounts to approximately PLN 4,313,000. The value of the entire project under this action is estimated at around PLN 138,000,000 (EUR 29,640,000).

In addition, an urban revitalisation good practice catalogue will be developed at an estimated cost of PLN 200,000 (EUR 42,950).
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</table>

	Total expenditure related to pre-investment costs will amount to PLN 427,400 (EUR 91,800). Operating expenses constitute the costs of greenery maintenance in the revitalised Sobieski Park (e.g., the costs of cleaning, vegetation maintenance, mowing and maintenance of facilities in the park area). The costs have been estimated on the basis of the Budget of the City of Warsaw. The unit cost per m^2 of park maintenance was estimated at 3.73 PLN. While the total annual operating expenses were estimated at PLN 1,193,000 (EUR 256,000).
Financing mechanisms / source	1. *Programme European Funds for Infrastructure, Climate, Environment 2021-2027,* • Objective 2.7 Strengthen the protection and conservation of nature, biodiversity, including in urban areas, and reduce pollution of all kinds, o CODE 78. protection, regeneration, sustainable use of Natura 2000 sites, o CODE 79. Protection of nature and biodiversity, natural heritage and resources, blue-green infrastructure. 2. *Just Transition Fund* • revitalisation and decontamination of degraded areas, restoration of functions to post-mining areas, and change of land use, 3. *National Fund for Environmental Protection and Water Management,* 4. *City's own resources.*
Impact on the implementation of the sustainable development goals	

SECTOR: WATER AND SEWAGE MANAGEMENT

Action W1

Construction of a municipal water treatment plant

Action W2

Programme for the modernisation and renovation of the city's water and sewerage infrastructure and the construction of water supply and sewerage networks in new areas of the city

Action W3

Smart water and sewage infrastructure management system

W1 Construction of a municipal water treatment plant

Timescale	Sector	Type of action	Objectives/ priorities
2023-2030		Capital investment	C9 - Development, effective use and protection of the city's water resources

Description of action	Construction of a water treatment plant that will allow us to become independent from external water suppliers outside the city. This construction will include a water treatment station with a capacity of approximately 700 m^3/h along with all the necessary equipment and technological installations needed to treat the water, including, for example, filtration, aeration, rinsing, pumping, chlorination, control, and monitoring. As part of these investments, there is a proposal to build clean water reservoirs to maintain a safe water reserve. A multi-discipline concept and feasibility study for this investment, together with a detailed analysis of the location for the foundation of the new facility should be developed before the investment process begins. In addition, in order to raise residents' awareness of proper water use and care for existing water resources, there are plans to increase the efficiency of rainwater (so-called rainwater) use by implementing a programme that would involve lending rainwater tanks to residents. The city is currently taking action to collect and store rainwater in specially adapted tanks. This measure has already been implemented on all schools in the city and on 50 public buildings. This water is mainly used for watering plants in the city. The planned programme would target housing communities and single-family house owners, to whom the city would lend water tanks.
Background and justification of action	Wałbrzych does not have its own water intake and water treatment plant. Water is supplied from Marciszów (approximately 20 km) and Unisław Śląski (approximately 9 km). The distance and the topography (the necessity of pumping to overcome the height of approximately 80 m) make the costs of water supply (related to energy demand and infrastructure maintenance) relatively high. Due to the historical use of land in Wałbrzych for mining purposes and the increasing climate change, which increasingly leads to short-lived but severe drought phenomena, the quality of water supplied to residents must be further developed and cared for. In the city, there is a problem with the lowering of groundwater, which in the case of prolonged periods without rainfall may exacerbate the problem with water supply. For this reason, the system of an independent water treatment plant in the city should be developed. The treatment of water in such a station takes place by de-gelatinizing it, softening it, ridding it of mechanical impurities and, in the case of chlorinated tap water, removing residual chlorine. Some of the advanced designs have the ability to rid the water of dangerous bacteria. The aforementioned effects are achieved using carbon filters and ion exchange resin cartridges. Activated carbon is responsible for removing chlorine particles, which significantly improves the taste of the water, and ion exchange resin, softens the water by trapping calcium and magnesium ions.

Schedule	**Action implementation steps**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
	Development of a multi-discipline concept and investment location study								
	Preparation of facility design and selection of contractors								
	Construction of a water treatment plant								
	Purchase of water tanks and implementation of a support programme for residents								
Action owner	Wałbrzych Water and Sewerage Company								
Main stakeholders	Environment and Climate Department								
Actions	• The water treatment plant will significantly improve the quality of water supplied to customers and increase the security of maintaining a continuous water supply, which could be reduced in the event of prolonged periods of drought. • The construction of well monitoring and the use of new treatment technology will ensure the stability of the water treatment process. The innovative technology will also save water resources and energy by reducing water and electricity losses.								
Enabling policies, strategies and actions	• Environmental Protection Program for the city of Wałbrzych - a city with powiat rights for 2016-2019, considering the 2023 perspective • Municipal Plan of Adaptation to Climate Change for Wałbrzych • Related to the planned action reported under the Just Transition Fund: "Construction of the Water Treatment Plant and groundwater intake based on the intake of water flowing out by gravity from the Fryderyk-Wilhelm adit in Wałbrzych". • Indirect connection with the urbanistic objectives of the Territorial Just Transition Plan: "projects for the organization of the drainage system of post-mining areas, including the use of post-mining waters, in particular the management of water outflow from closed workings in order to maintain good condition of water courses and ensure continuity of water supply drinking water for residents (installations for obtaining water, without water and sewage systems)".								
Result indicators	• Achieving the assumed capacity of the water treatment plant [m^3/h] • Number of new installed rainwater tanks [pcs.]								
Potential to develop inclusivity and improve social aspects	• An inclusive recruitment process should be applied in all generated new employment opportunities.								

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Reduced costs of the water supply for the households by using the rainwater tank rental program.
Using the rainwater tank rental program under favorable conditions for economically vulnerable households.

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<tr><td>Potential for the implementation of innovative and smart technologies</td><td>

The implementation of a trunk network monitoring system at nodal points and a water intake monitoring system.
The deployment of sensors (pressure and flow sensors in first place), smart water metering, the development of complete GIS, hydraulic model, would constitute key building blocks towards the development of digital twin of the water network.

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<tr><td>Mapping of risks, challenges</td><td>

The risk related to thermal extremes in the water supply subsystem results from possible complications related to the increased growth of bacteria in the network and reservoirs, which necessitates the selection of more complicated methods of water treatment. In hot weather and elevated temperatures in dry weather, there is a risk of reduced flow in the combined sewer network. An additional threat in the city is the fact that the water level in deep water intakes is constantly decreasing. If climate change continues, the water table may turn out to be low enough to disrupt the city's water supply. In the context of water management, a significant problem is also the occurrence of prolonged periods without precipitation or extreme rains, and because of floods causing failures of water treatment systems. The construction of an independent water treatment plant by the city will minimise the identified risks.

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<tr><td>Costs</td><td>
<table>
<tr><th>Pre-investment</th><th>Capital expenditure</th><th>OPEX</th></tr>
<tr><td>PLN 2,000,000
EUR 429,500</td><td>PLN 150,315,000
EUR 32,280,000</td><td>PLN 174,000
EUR 37,000</td></tr>
<tr><th colspan="3">Potential forms of savings</th></tr>
<tr><td colspan="3">

The construction of a water treatment plant will avoid additional costs associated with the use of the plant, which is currently located outside the city area.
Additional reservoirs at individual households will save residents the financial resources incurred in purchasing water for the purpose of watering vegetation or washing vehicles.

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<tr><td>Cost calculation</td><td>
Data source: Waterworks and Sewage System Company in Wałbrzych, Wałbrzych Municipality Office, Zgorzelec-based Municipal Utilities Company, Projects implemented by Arup.

Pre-investment expenditure represents the cost of developing a multi-discipline concept and feasibility study for this investment together with a detailed analysis of the location of the foundation of the new facility - PLN 2,000,000 (EUR 429,500).

The costs of building a new water treatment plant were estimated on the basis of materials provided by the city. The capacity of the new facility was determined on the basis of the city's current water demand (using a daily irregularity coefficient of
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</table>

	1.5) and is approximately 700 m^3/h. The estimated cost of building such a facility, together with the associated infrastructure, is PLN 150,000,000 (EUR 32,212,000). The cost of implementing the rainwater tank lending programme, including the purchase of 100 decorative water tanks in the shape of a tree trunk with a capacity of 475 liters each and the purchase of 100 standard tanks with a capacity of 1,000 liters each, was estimated at PLN 315,000 (EUR 67,000). The average cost of 1 tank was estimated at approximately PLN 1,500. Annual operating costs were estimated at approximately 0.5% of total capital expenditure and represent the cost of repairs, maintenance, repairs, electricity, replacement of deposits, treatment agents and water for filter rinsing.
Financing mechanisms / source	1. *National Reconstruction Plan* • B3.4.1 Investments for comprehensive green transformation of cities, loans, 2. *Programme European Funds for Infrastructure, Climate, Environment 2021-2027* • Objective 2.5 Promote access to water and sustainable water management o CODE 62. Provision of water for human consumption (infrastructure for abstraction, treatment, storage and distribution, efficiency measures, drinking water supply), o CODE 64. Water management and conservation (including river basin management, specific climate change adaptation measures, reuse, leakage reduction). *3. Just Transition Fund* • revitalisation and decontamination of degraded areas, restoration of functions to post-mining areas, and change of land use, *4. National Fund for Environmental Protection and Water Management,* *5. Provincial Environmental Protection and Water Management Fund,* *6. Loans, credits, green bonds.*
Impact on the implementation of the sustainable development goals	

W2 Programme for the modernisation and renovation of the city's water and sewerage infrastructure and the construction of water supply and sewerage networks in new areas of the city

Timescale	Sector	Type of action	Objectives/ priorities
2023-2025		Capital investment	C10 – Improving and strengthening the functioning of the city's wastewater management

Description of action

Implementation of the modernization program and development of the water and sewage infrastructure, including:

1. Modernisation of the water supply network of poor technical condition in streets: Szmidta, Chrobrego, Plac Grunwaldzki, Słowackiego, Nowy Świat, Aleja Wyzwolenia, Wysockiego.
2. Modernization of sanitary sewer network with insufficient capacity in streets: Piasta, Podgórska.
3. Extension of the water supply system in all investment areas of the city.

In addition, a full analysis of the technical condition of the stormwater drainage system is planned as part of the measure, together with identification of the needs and scope of investment and renovation measures.

Background and justification of action

There are areas within the city of Wałbrzych where the water supply network is in poor technical condition and needs to be replaced. Areas where the sewerage network has insufficient capacity is also identified. It is therefore necessary to modernize it by replacing sections with too small diameter or by building additional sewers to redirect wastewater to less loaded sections of the sewer system.

There are also areas in the city that are attractive to investors, but with inadequate water and sewerage infrastructure or the existing sewerage network does not have sufficient capacity. This is a major obstacle to the development of the city.

Schedule

Action implementation steps	2023	2024	2025	2026	2027	2028	2029	2030
Development of a complete analysis of the technical condition of the rainwater drainage system with the determination of the needs and scope of investment and renovation measures								
Design work								
Implementation of construction works related to the modernisation of the water and sewage network								

Action owner

Wałbrzych Water and Sewerage Company

Main stakeholders

Environment and Climate Department

Action benefits	• The modernisation of the water supply and sewerage network, as well as the expansion of the water supply system, will have a positive impact on the image of the city, improve the standard of living of its inhabitants and encourage new investors.		
Enabling policies, strategies and actions	• Environmental Protection Program for the city of Wałbrzych - a city with poviat rights for 2016-2019, considering the 2023 perspective • Related to the planned action reported under the Just Transition Fund: "Construction, expansion and modernization of the sewage network as well as modernization and expansion of the water supply network in Piasta Street in Wałbrzych (for the needs of "A housing estate near Chełmce"). • Indirect connection with the urbanistic objectives of the Territorial Just Transition Plan: "projects for the organization of the drainage system of post-mining areas, including the use of post-mining waters, in particular the management of water outflow from closed workings in order to maintain good condition of water courses and ensure continuity of water supply drinking water for residents (installations for obtaining water, without water and sewage systems)".		
Result indicators	• Length of the modernized water supply network [km] • Length of the modernized sanitary sewage system [km] • Length of the newly created water supply network [km]		
Potential to develop inclusivity and improve social aspects	• Improved living conditions of the citizens. • The development of infrastructure in the city's investment areas will help attract new investors, creating development and working conditions for Wałbrzych's residents.		
Potential for the implementation of innovative and smart technologies	In the course of replacing/upgrading/constructing a water supply or sewerage network, innovative and smart technologies can be used such as: • Gate valves with an electric motor with the possibility of remote opening/closing • Gate valves with devices measuring the degree of opening • Flow and pressure measurement devices for water mains • Filling and flow measurement devices for sewer • Installation of IR or LoraWan sensors to locate leaks and losses proactively • Mapping the system for the digital twin.		
Mapping of risks, challenges	• One of the technological risks identified in Wałbrzych is unsatisfactory conditions of the water supply system. As part of this action, it is planned to replace sections of water mains that are in unsatisfactory condition.		
Costs	**Pre-investment**	**Capital expenditure**	**OPEX**
	PLN 340,300	PLN 3,628,100	PLN 90,700

	EUR 73,100	EUR 779,100	EUR 19,500
	Potential forms of savings		
	• Upgrading the currently existing inefficient water and sewerage network will avoid the costs associated with numerous network renovations and repairs in the future.		
Cost calculation	Data source: Waterworks of the City of Kraków, Wałbrzych City Council, Projects implemented by Arup. Pre-investment costs represent the expense of preparing a full analysis of the technical condition of the rainwater drainage system, together with determining the needs and scope of investment and renovation activities, estimated at approximately PLN 50,000 (EUR 10,700). In addition, 8% of capital expenditure on the design documentation for the indicated modernisation projects on the water and sewerage network was also included here - PLN 290,300 (EUR 62,300). The cost of rebuilding 1 m of water and sewerage network was estimated at: - PE SDR11 multilayer pipes with a diameter of 355 mm - PLN 900 - SDR11 multilayer PE pipes with a diameter of 280 mm - PLN 800 - SDR11 multilayer PE pipes with a diameter of 225 mm - PLN 680 - SDR11 multilayer PE pipes with a diameter of 160 mm - PLN 450 - SDR11 multilayer PE pipes with a diameter of 125 mm - PLN 400 The costs of rebuilding 1 m of sewer network were estimated at: - PVC SDR11 pipes with a diameter of 355 mm - PLN 800 The estimated capital expenditure represents the cost of replacing/upgrading the identified sections of the water mains that require repairs. The total length of the water and sewage network which should be modernised is 882.4 m. And the total cost of the projects planned under the measure will amount to PLN 602,755 (EUR 129,000). 1. Szmidta Street - 133.9 m - PE 100 SDR11 280 x 16.6 mm - PLN 107,120 2. Chrobrego Street - 149.3 m - PE100 SDR11 355 x 32.2 mm - PLN 134,370 3. Chrobrego Street - 150.8 m - PE100 SDR11 125 x 11.4 mm - PLN 60,360 4. Grunwaldzki Square - 57 m - PE100 SDR 355 x 32.2 mm - PLN 51,300 5. Słowackiego Street - 98.8 - PE100 SDR 355 x 32.2 mm - PLN 88,920 6. Nowy Świat Street - 64.5 m - PE100 SDR 160 x 14.6 mm - PLN 29,025 7. Wyzwolenia Avenue - 144.5 m - PE100 SDR 225 x 20.5 mm - PLN 98,260 8. Wyzwolenia Avenue - 22.1 m - PE100 SDR 125 x 11.4 mm - PLN 8,840 9. Wysockiego Street - 61.4 m - PE100 SDR 125 x 11.4 mm - PLN 24,560 In addition, it is recommended to extend the sewerage network in selected areas of the city using 355mm diameter PVC pipes. The total length of the sewerage		

	network that should be modernised is 2,270 m. And the total cost of the projects planned under the measure will amount to PLN 1,816,000 (EUR 390,000). 1. Piasta Street – 1,000 m - PLN 800,000 2. Podgórska Street - 400 m - PLN 320,000 3. 'Pod Chełmcem' area - 870 m - PLN 696,000 Due to the characteristic hilly terrain of the city, it should be estimated that the costs associated with the groundworks may increase by up to 50%. For this reason, an additional PLN 1,209 ,400 increased the initial value of the capital expenditure. The total value of the final capital costs is PLN 3,628,100 (EUR 779,100). Operating costs represent the annual expenditure associated with the operation and maintenance of the built infrastructure (i.e., repairs, maintenance and network flushing water). In total, this is estimated to be approximately 0.5% of the initial investment outlay. An equally important cost item is the property tax of 2% of the investment outlay - PLN 90,700 (EUR 19,500).
Financing mechanisms / source	1. *National Reconstruction Plan* - B3.4.1 Investments for comprehensive green transformation of cities, loans, 2. *European Funds for Infrastructure, Climate, Environment 2021-2027 Programme* • Objective 2.5 Promote access to water and sustainable water management o CODE 62. provision of water for human consumption (infrastructure for abstraction, treatment, storage and distribution, efficiency measures, drinking water supply), o CODE 64. Water management and conservation (including river basin management, specific climate change adaptation measures, reuse, leakage reduction). o CODE 65 Wastewater collection and treatment, o CODE 66. Wastewater collection and treatment complying with energy efficiency criteria. *3. National Fund for Environmental Protection and Water Management,* 4. *Provincial Fund for Environmental Protection and Water Management*.
Impact on the implementation of the sustainable development goals	

W3 Smart water and wastewater infrastructure management system

Timescale	Sector	Type of action	Objectives/ priorities
2023-2026		Enabling action	C10 – Improving and strengthening the functioning of the city's wastewater management

Description of action

Implementation of smart system for managing water and sewage infrastructure. This system will consist of:

- GIS database with complete information on water and wastewater infrastructure,
- SCADA system (a computer system that collects data from remote measuring devices),
- Water network model,
- Sewage network model.

In order to implement this system, the following actions are required:

- Inventory of water supply and sewerage networks,
- Implementation of water network monitoring,
- Extension of the sewage network monitoring,
- Measurement campaign,
- Construction and calibration of water supply and sewage network model,
- Incorporation of all components into one integrated system.

As a result, a specific city map will be created, showing the course of the water and sewage network. It will provide all the information needed by the relevant operating services, authorities and stakeholders in the city, investors, designers, surveyors, municipal services and, above all, residents. The database, of which the map will be only an illustration, will bring together all the information on the water and sewage network. Data will be available about the diameter of pipelines, their age, it will be possible to find information on failures, possible extensions to the water supply and sewage network and to check water pressure in selected areas. The database will be based on the GIS (Geographical Information System) technology, which allows the input, collection, processing and visualization of geographical data.

Background and justification of action	Increasing frequency of heavy rainfalls caused by climate change, resulting in increasingly severe overloading, flooding and failure of the sewerage network is noticed. There is also a progressive build-up of green spaces with impermeable surfaces in cities, which reduces the possibility of rainwater infiltrating into the ground. In addition, there is also increasing pressure on water companies to reduce operating costs on both sewerage and water supply networks. Existing, often outdated methods and solutions have not kept up with climate change and infrastructure development. It is therefore necessary to implement modern solutions so that the infrastructure in operation can be managed efficiently. Smart management systems for water and wastewater infrastructure are increasingly being used to support the activities of company employees.
Schedule	**Action implementation steps** / 2023 / 2024 / 2025 / 2026 / 2027 / 2028 / 2029 / 2030
	Inventory of water supply and sewage networks
	Implementation of monitoring of the water supply and sewage systems
	Conducting a measurement campaign
	Construction and calibration of a water and sewage network model
	Integration of all components into one integrated system
Action owner	Wałbrzych Water and Sewerage Company
Main stakeholders	Environment and Climate Department IT Department
Action benefits	The implementation of a smart water and wastewater infrastructure management system, including mathematical models of the water and wastewater network, allow: • Streamlining the process of managing the network assets, • Accurate assessment of problems in the network, • Efficient planning of repairs, modernisation and replacement of networks, • Verification of planned technical solutions, • Creation of design guidelines, • Analyses for network maintenance, • Analyses for Local Development Plans, • Automation of processes on the network, • Forecasting of network operation, performance and efficiency,

<table>
<tr><td></td><td colspan="3">• Flood risk assessment (for the sewer model).</td></tr>
<tr><td>Enabling policies, strategies and actions</td><td colspan="3">• Municipal Plan of Adaptation to Climate Change for Wałbrzych
• Environmental Protection Program for the city of Wałbrzych - a city with poviat rights for 2016-2019, considering the 2023 perspective</td></tr>
<tr><td>Result indicators</td><td colspan="3">• Number of objects entered into the GIS database and completeness of information
• Number of measurement points implemented into the SCADA system [pcs.]</td></tr>
<tr><td>Potential to develop inclusivity and improve social aspects</td><td colspan="3">• Improved living conditions of the citizens due to shortened time for identification and repairs of failures, affecting the reliability of the water and sewage networks for the residents.</td></tr>
<tr><td>Potential for the implementation of innovative and smart technologies</td><td colspan="3">• A smart water and sewerage infrastructure management system is an innovative and smart technology. In addition, it will enable further development and can be the basis for online predictive and real time control (RTC) models. The operation of such models is based on continuous real-time re-calculation of hydraulic parameters based on real measurements from the SCADA system.</td></tr>
<tr><td>Mapping of risks, challenges</td><td colspan="3">• In Wałbrzych, there has been a steady increase in annual precipitation totals and the frequency of occurrence of high precipitation daily total. A hydrodynamic model of the rainwater and combined sewer system will make it possible to assess the operation of the network at any precipitation event, which will allow efficient planning of sewer upgrades and extensions, thereby increasing resilience to climate change.
• One of the technological risks identified in Wałbrzych is the unsatisfactory condition of the water supply and sewage system. With a smart water and sewage infrastructure management system, it will be easy to assess which sections of the network need to be replaced and in what order.</td></tr>
<tr><td rowspan="3">Costs</td><td>Pre-investment</td><td>Capital expenditure</td><td>OPEX</td></tr>
<tr><td>-</td><td>PLN 37,000,000
EUR 7,945,000</td><td>PLN 504,000
EUR 108,000</td></tr>
<tr><td colspan="3">Potential forms of savings</td></tr>
<tr><td colspan="3">• The implementation of this system will optimise the costs associated with water and sewerage network repairs and more efficient use of water supply networks, reducing the final costs of water production and treatment on the bills of residents as well as public authorities.</td></tr>
</table>

Cost calculation	Data source: Municipal Water and Sewage Company in Wroclaw, Wałbrzych City Council, InVałbrzych, Projects implemented by Arup. Capital expenditure is the cost that must be incurred for the comprehensive supply and overall commissioning of the city's water and sewerage infrastructure management system (e.g., installation of an appropriate number of metering devices, creation of a database, inventory of the water and sewerage network and purchase of appropriate software) - PLN 37,000,000 (EUR 7,945,000). The annual operating costs represent the cost of maintenance and repair of the measuring equipment, the cost of licenses and subscriptions for the use of software PLN 504,000 (EUR 108,000).
Financing mechanisms / source	1. *National Reconstruction Plan* - B3.4.1 Investments for comprehensive green transformation of cities, loans, - C2.1.1. E-public services, IT solutions to improve the functioning of the administration and economic sectors and breakthrough technologies in the public sector, economy and society, grants. 2. *European Funds for Infrastructure, Climate, Environment 2021-2027 Programme* • Objective 2.5 Promote access to water and sustainable water management o CODE 62. provision of water for human consumption (infrastructure for abstraction, treatment, storage and distribution, efficiency measures, drinking water supply), o CODE 64. Water management and conservation (including river basin management, specific climate change adaptation measures, reuse, leakage reduction). o CODE 65 Wastewater collection and treatment, o CODE 66. Wastewater collection and treatment complying with energy efficiency criteria. *3. National Fund for Environmental Protection and Water Management,* 4. *Provincial Fund for Environmental Protection and Water Management*.
Impact on the implementation of the sustainable development goals	

Cross-sectoral actions

M1 Promoting advanced forms of training in industry and services			
Timescale	**Sector**	**Type of action**	**Objectives/ priorities**
2023-2030		Enabling action	C12 - Building a strong and informed local community and social activation
Description and scale of action	Conducting educational and information campaigns, trainings, or workshops in cooperation with local educational institutions in regional workplaces and other institutions in the industrial and service sectors within the city. The educational trainings will include the transfer of up-to-date and innovative knowledge and information on the functioning of the city in the era of digitalisation and smart technology, expanding the knowledge of current trends in the global market. The action will aim to promote the development of local entrepreneurship and innovation leading to economic diversification and job creation, by providing training in: engineering and asset management, digitisation development, and investment in green technologies. Increasing the professional competence of the staff of services and institutions dealing with actions in the area, through continuous improvement of knowledge and social actions in the city (postgraduate studies, qualification courses, improvement courses, training, workshops). The action would support the development of initiatives planned in the city, including the creation of an Entrepreneurship Academy. The project will involve economic activation and strengthen competitiveness by supporting the development of entrepreneurial thinking in the region, including climate neutrality. The project also aims to develop entrepreneurship and business activity in the Wałbrzych sub-region, including the improvement of professional competences of 1,000 adults, for those working and looking for work, reporting from their own initiative the need to improve their qualifications/professional competences. The action consists of conducting a series of training courses and conferences as well as providing vocational counselling/coaching.		
Background and justification of action	The EBRD's inclusive response to the refugee crisis targets host communities and refugees alike and aims to help lessen pressure on social cohesion and have an immediate impact. It delivers investments to alleviate the strain on public services. It aims to increase employment opportunities through finance and advice to small businesses. It also offers inclusion programmes to facilitate economic participation through skill mapping and training, especially for young people and women. The Wałbrzych Business Incubator, an initiative supporting the establishment and development of micro and small enterprises operating in the city of Wałbrzych, started operating in 2021. As part of its activities, it offers, among other things, specialised training and skills training and counselling services for those wishing to set up a business or develop a business idea. The development of educational training courses and initiatives will provide an opportunity for unemployed, young people to increase their professional qualifications or to expand their opportunities on the labour market by re-branding themselves for current trends on the local labour market. There are 5,800 registered unemployed people in Wałbrzych (as of 10/2022) who could potentially take part in the programme to retrain and potentially gain employment.		

	Schools, kindergartens and other educational institutions are central places for social integration in the respective neighbourhoods, which makes it possible to have direct contact with the inhabitants and provides an opportunity to effectively transfer knowledge or information related to the current needs of the city.
Schedule	**Action implementation steps** | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030
	Assessment of current trends in the city market
	Selection of the body responsible for running the campaign/programme
	Development of initiatives planned in the city
Action owner	Education and Social Affairs Department
Main stakeholders	InVałbrzych Sp. z o.o. Wałbrzych Special Economic Zone "INVEST-PARK" Sp. z o.o. Poviat Employment Office in Wałbrzych Educational establishments and training institutions
Action benefits	• Development of entrepreneurship and economic diversification • Improving the professional qualifications of residents • Decrease in the level of unemployment in the city
Enabling policies, strategies and actions	• Strategy for Solving Social Problems of the city of Wałbrzych for 2016-2025, • Linked to the planned action submitted under the Just Transition Fund: "SPINACZ - Partnership for the Development of Vocational Education". • Related to the social objectives of the Territorial Just Transition Plan: "support services for people excluded or at risk of exclusion, affected by the negative consequences of the transformation"; "raising the competences necessary to meet the changing requirements of the labour market resulting from the ongoing transformation"; "support of infrastructure for education and social exclusion: improving the availability and quality of educational, primary, secondary, vocational and technical education infrastructure for the training of professions related to energy and economic transformation".
Result indicators	• Number of initiatives implemented to improve professional skills and enable entrepreneurship in the city.
Potential to develop inclusivity and improve social aspects	• Capacity building and skill learning which would facilitate job finding or changing profession, especially for the economically vulnerable households,

<table>
<tr><td></td><td>

- Ensuring balanced participation of representatives of all genders in the process of developing and implementing the action.

</td></tr>
<tr><td>Potential for the implementation of innovative and smart technologies</td><td>

- Increase users' use of digital and smart technologies through educational training.
- With the increase in digital literacy, the possibility of the city to use digital technologies can be increased.
- New start-ups working on digital technologies can be established in the city.
- Potential to identify different free/paid online training (in line with the skill needed in the city) and present them on a platform or the city's webpage.
- Facilitate digital maturity assessment of SMEs to support their digital transformation.

</td></tr>
<tr><td>Mapping of risks, challenges</td><td>

- The city is experiencing the phenomenon of young, skilled people migrating to other cities to find work. Creating prospects for young and skilled workers will counteract the risk of migration of people of working age.
- By reducing the number of unemployed in the city, the risk of strikes or discontent among residents will be reduced.

</td></tr>
<tr><td>Costs</td><td>
<table>
<tr><th>Pre-investment</th><th>Capital expenditure</th><th>OPEX</th></tr>
<tr><td>-</td><td>PLN 5,000,000
EUR 1,073,000</td><td>-</td></tr>
<tr><td colspan="3">Potential forms of savings</td></tr>
<tr><td colspan="3">

- This action will improve the economic situation of residents.

</td></tr>
</table>
</td></tr>
<tr><td>Cost calculation</td><td>Data source: Application form for a project submitted in the invitation to the list of non-competitive projects planned for implementation within the Just Transformation Fund in areas covered by the Territorial Just Transition Plan, Wałbrzych City Hall.

Capital expenditure would be associated with the implementation of the initiative to set up the Entrepreneurship Academy indicated below PLN 5,000,000 (EUR 1,073,000): This expenditure would relate to the organisation and coordination of the delivery of conferences, training and career guidance services.</td></tr>
<tr><td>Financing mechanisms / source</td><td>

1. *National Reconstruction Plan*

- A2.4.1 Investment in research capacity building, grants,
- A3.1.1. Support for the development of modern vocational education, higher education and lifelong learning, grants,
- A4.1.1. Investments to support the reform of labour market institutions, grants,

</td></tr>
</table>

	• A4.3.1. Investment support programmes enabling the development of activity, increasing participation in the provision of social services and improving the quality of reintegration in social economy entities, grant • A4.6 Increase in labour market participation of certain groups through the development of long-term care, grants. 2. *Just Transition Fund* • Improving and retraining workers and jobseekers, 3. *Own funds of the city*.
Impact on the implementation of the sustainable development goals	

M2 Creation of the Wałbrzych Centre for Integration of Foreigners			
Timescale	**Sector**	**Type of action**	**Objectives/ priorities**
2023-2024		Enabling action	C4 - Provision of accessible, high-quality services, social and housing infrastructure
Description and scale of action	Establishment of the Wałbrzych Centre for Integration of Foreigners and its subordinate centres in individual districts of the city where minorities of Ukrainian nationality live. The action includes hiring an appropriate staff of specialists to operate the Centre and provide services in the field of: • Providing general information on the functions and location of the Centre in relation to the most important administrative centres, including the Wałbrzych City Hall and the Municipal Social Welfare Centre, the range of possible courses, trainings to learn the Polish language and improve qualifications, translations of documents, the possibility to leave a child in the care of the community centre, the schedule of educational and cultural events, etc.; • Provision of detailed administrative information concerning, inter alia, the number of benefits to which they are entitled, types of social support, possibilities of obtaining subsidies, assistance in handling and submitting applications; information on the possibility of applying for permanent and temporary residence assistance in handling and submitting applications, etc.; • Missing persons' point - possibility to receive information about the whereabouts of family, relatives, friends, establishing contact between the seeker and the person sought; • Providing day care for children - this facility must be adequately equipped with an activity room, canteen, kitchen and playground (garden) and must employ appropriate staff to care for children; • Creation and maintenance of a day-care centre and relaxation area for adults, which would also be a place where help can be found among the Ukrainian community - information exchange, help in finding a job, childcare, etc. not in the form of systemic help, but help "through friends"; • The organisation of free Polish language courses and vocational training to improve professional qualifications (courses with elements of learning about Polish culture); • Organisation of free educational workshops for children and adults and classes on Polish and regional culture; • Free psychological support for children and adults, including conducting "support group" meetings; • Career counselling, legal advice; • Organisation of events by the Ukrainian community for the inhabitants of a particular neighbourhood or the whole of Wałbrzych, (e.g., in order to familiarize the local community with Ukrainian culture);		

	• Organisation of campaigns against xenophobia to sensitise the residents of Wałbrzych to the problems of refugees from Ukraine - these people did not come here in order to increase competition on the labour market, but to protect their own and their relatives' life and health - trauma and post-traumatic stress disorder. Additional functionality of this facility could be supported by an educational and childcare preparatory unit for children and adolescents together with a bilingual kindergarten (Ukrainian and Polish) for the youngest. The Centre for the Integration of Foreigners could control and operate the designated units. A detailed scope of work aimed at establishing activity centres for the Ukrainian community in Wałbrzych will be developed as a result of a separate Rapid Infrastructure Resilience Appraisal & Action Plan project carried out by the Wałbrzych City Hall, which aims to identify priority social and hard infrastructure needs and soft measures that respond to the challenges raised by the conflict in Ukraine.
Background and justification of action	The Russian invasion of Ukraine in February 2022 forced part of the Ukrainian population to flee the country. As a consequence, there has been a massive influx of refugees from Ukraine to Poland, including Wałbrzych. Approximately 2,500 refugees from Ukraine have found accommodation in the city of Wałbrzych - these are people registered by the Wałbrzych City Hall with a PESEL identification number. The actual number of refugees in Wałbrzych is likely to be as high as 5,000, representing almost 5% of the city's population. The sudden situation of the migration crisis has forced the public administration to take on new challenges in improving the action of the refugee assistance system. The City Hall of Wałbrzych, in agreement with the Municipal Social Welfare Centre and supported by people of goodwill, organised accommodation for the refugees from Ukraine from the beginning of their arrival in the city. Among the refugees, the majority were women with children and elderly people, often requiring constant medical care. Due to the prolonged armed conflict in Ukraine, a significant number of refugees have remained in the city, finding work here. Among the refugees, there is a large group of people who plan to settle permanently in Wałbrzych. Children of Ukrainian refugees have been provided with Polish crèches, kindergartens and schools, and caregivers registered with the authorities have been given access to family benefits such as 500+ and other benefits, including social assistance. The influx of a large group of refugees from the Ukraine to Wałbrzych and the prolonged period of their stay in the city has damaged the stability of Wałbrzych's local community. Crèches, kindergartens and schools are overcrowded, which, in the case of schools, has had the effect of reducing the quality of education for children of both nationalities - Polish and Ukrainian. School day care centres, when accepting children from the Ukraine, have to deny Polish families care for their children. The language barrier and cultural differences make it difficult for Ukrainian refugees to find work. It is particularly difficult for those with a university degree to find work in their profession due to: 1) the need to translate diplomas from Ukrainian into Polish (the refugee did not necessarily have to bring these documents with him/her to Poland); 2) specialisation not applicable on the Polish labour market e.g. private law firms from Ukraine, legal advisor on Ukrainian civil law. In addition, most of the incomers from Ukraine are women with children, who do not want to put their children in a nursery / kindergarten or are afraid to take up a job, which may be related to a different family model in

	Ukraine - the man works and the woman takes care of the children and the house. The described challenges resulting from the acceptance of refugees from Ukraine by Wałbrzych coincide with the existing problems in the city, which are already faced by residents, including officials, as well as people of Ukrainian nationality. In view of the above, in order to improve the quality and living conditions of refugees from Ukraine in Wałbrzych, and to end conflicts between the native and immigrant communities, the City Hall of Wałbrzych wants to take a number of urgent actions aimed at making this nationality group independent, while at the same time accepting the presence of these people by the inhabitants of Wałbrzych. The self-reliance will be possible by providing refugees from Ukraine with the opportunity to take part in free Polish language courses i as well as various professional trainings and educational-social-cultural workshops whilst simultaneously, encouraging the inhabitants of Wałbrzych to participate in cultural events prepared by people of Ukrainian nationality. Adopting such a course of action will make it possible to reduce the language barrier between Poles and Ukrainians and to understand the source of the chosen behavior of both sides resulting from cultural differences. Only in this way will we avoid future nationality-based conflicts in the city. In view of the next wave of refugees from Ukraine - mainly women with children and the elderly - expected in the autumn-winter period 2022/23, taking urgent action to create the Wałbrzych Centre for Education of Foreigners and its subordinate activity centres in individual districts of the city where minorities of Ukrainian nationality live should be treated as a priority action.
Schedule	**Action implementation steps** / 2023 / 2024 / 2025 / 2026 / 2027 / 2028 / 2029 / 2030
	Selection of location for Wałbrzych Centre for Integration of Foreigners
	Refurbishment/construction and equipment of the Centre
	Analysis of the need for district activity centres for the Ukrainian community
	Completion of a cadre of specialists to operate neighbourhood activity centres for the Ukrainian community
Action owner	Education and Social Affairs Department
Main stakeholders	Municipal Social Welfare Centre in Wałbrzych Organisational Department Childcare facilities Educational institutions

<table>
<tr><td>Action benefits</td><td>• Population growth in the city and development of the job market
• Improving social inclusion
• Improving working and living conditions in the city for foreigners</td></tr>
<tr><td>Enabling policies, strategies and actions</td><td>• Act of 12 March 2022 on assistance to citizens of Ukraine in connection with the armed conflict on the territory of that state (Journal of Laws 2022, item 583)
• Ordinance No. 197/2022 of the Mayor of the city of Wałbrzych of 18 March 2022 on the organisation of assistance to citizens of Ukraine, in connection with the armed conflict on the territory of that state, arriving in the city of Wałbrzych
• Rapid Infrastructure Resilience Appraisal & Action Plan project conducted in the city in cooperation with the European Bank for Reconstruction and Development</td></tr>
<tr><td>Result indicators</td><td>• Creation of the Wałbrzych Centre for Integration of Foreigners</td></tr>
<tr><td>Potential to develop inclusivity and improve social aspects</td><td>• An inclusive recruitment process should be applied in all generated new employment opportunities.
• Enabling the economic and social inclusion of foreigners in the society, through provision of childcare and teaching Polish language.
• Provision of assistance to vulnerable groups to comply with administrative and legal procedures.
• Opportunity to identify any individuals or groups that require special attention, e.g., psychological help, shelter for victims of violence, etc.</td></tr>
<tr><td>Potential for the implementation of innovative and smart technologies</td><td>• A mobile phone application such as ‘find your mate’ can be developed, through which residents of Wałbrzych can come together with a Ukrainian to assist them in their adaptation to Wałbrzych city life. In order to strengthen this adaptation and reduce racism, the practice of xenia (guest-friendship) can be applied to the elimination of the intercultural barrier between the Ukrainian and Polish populations.</td></tr>
<tr><td>Mapping of risks, challenges</td><td>• In the future, cultural and political differences may exacerbate conflicts between the Polish and Ukrainian/foreigner communities. The establishment of the Wałbrzych Centre for Integration of Foreigners will reduce the risk of conflicts and promote better integration.
• Potential conflicts arising from high language or cultural differences.</td></tr>
<tr><td>Costs</td><td>
<table>
<tr><th>Pre-investment</th><th>Capital expenditure</th><th>OPEX</th></tr>
<tr><td>-</td><td>PLN 917,880
EUR 196,970</td><td>PLN 1,740,000
EUR 373,400</td></tr>
<tr><th colspan="3">Potential forms of savings</th></tr>
<tr><td colspan="3">-</td></tr>
</table>
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</table>

Cost calculation	Data source: CSO statistics "Employment and wages in the national economy in the first quarter of 2022", EU Grant Map, UM Wałbrzych.
	The capital expenditures of the Wałbrzych Centre for Integration of Foreigners are related to its organisational set-up (they do not include the costs of construction of a new building). These are expenses related to, providing assistance for the integration of refugees and preparing this group to take up employment in Poland, organising Polish language courses for foreigners together with the development of appropriate educational materials, organising vocational training to improve professional qualifications and purchasing appropriate equipment. Capital expenditure was estimated on the basis of projects made available under the EU Grant Map and will amount to approximately PLN 917,880 (EUR 196,970). Operational costs are related to the maintenance of the buildings, including electricity, waste disposal, water sewage and the annual salary of 25 employees of the Centre for Integration of Foreigners. The number of employees is expected to increase cyclically in future. These expenses were estimated on the basis of the Wałbrzych City Budget and statistical data published by the Central Statistical Office (average monthly salary in the local government sector of PLN 5,800)- annually estimated at around PLN 1,740,000 (EUR 373,400).
Financing mechanisms / source	1. *National Reconstruction Plan* • A3.1.1 Support for the development of modern vocational education, higher education and lifelong learning, grants, • A4.1.1. Investments in support of the reform of labour market institutions, grants, • A4.3.1. Investment support programmes enabling the development of activities, increasing participation in the provision of social services and improving the quality of reintegration in social economy entities, grant • A4.6 Increase in labour market participation of certain groups through the development of long-term care, grants. 2. *Own funds of the city*
Impact on the implementation of the sustainable development goals	

M3 Adaptation of infrastructure and teaching facilities in Wałbrzych educational facilities for Ukrainian refugees

Timescale	Sector	Type of action	Objectives/ priorities
2023-2025		Enabling action	C4 - Provision of accessible, high-quality services, social and housing infrastructure

Description and scale of action

The action consists of providing favorable didactic and developmental conditions for refugee children from Ukraine, who are taught in Polish-language groups (classes), while supporting and developing education for Polish children. The adaptation is intended to cover all educational units in Wałbrzych - a total of 28 sites, of which 80 teachers and 65 specialists (including child school psychologists) will be trained in at least the following:

- Learning the basics of the Ukrainian (and Russian, which is used by some refugees);
- Learning about the cultural diversity of the Ukrainian community, including regional differences, as well as educational differences;
- Acquiring practical knowledge on how to organise group adaptation activities in Polish-Ukrainian classes;
- Raising awareness of the needs of Ukrainian refugees, the need to provide proper care for Ukrainian children (trauma, traces of war in the psyche);
- Learning to cope with stressful situations in relation to inappropriate behaviour of students.

Furthermore, the action includes the strengthening of teaching facilities in terms of increasing the teaching staff, including employment of Polish language teachers, in order to reduce class sizes to a maximum of 30 students and thus increase teaching effectiveness. It is estimated that at least 15 new teachers would need to be recruited to reach this target.

In addition, the action will provide psychological support for teachers, a pre-school psychologist and all administrative staff employed in schools attended by Ukrainian children.

Adaptation of infrastructure will include equipping schools with accessories necessary for remote learning by teachers and use of such learning by students, i.e., laptops, screens, wireless mice, keyboards, headphones. The need for servicing and replacing parts has been considered in ensuring the right equipment.

A detailed scope of work aimed at adapting the infrastructure and teaching facilities of Wałbrzych's educational institutions for Ukrainian refugees will be developed as a result of a separate project (Rapid Infrastructure Resilience Appraisal & Action Plan), implemented by the Wałbrzych City Hall, which aims to identify priority social and hard infrastructure needs and soft measures that respond to the challenges raised by the conflict in Ukraine.

Background and justification of action	The sudden influx of a large group of refugees from Ukraine to Wałbrzych and the prolonged period of their stay in the city has damaged the stability of Wałbrzych's local community. Crèches, kindergartens and schools are overcrowded, which, in the case of schools, has had the effect of reducing the quality of education for children of both nationalities - Polish and Ukrainian. The language barrier and cultural differences make it difficult for schoolteachers. Psychological support for children is insufficient - there is a lack of Polish child psychologists, and in the case of children with war trauma, child psychologists with knowledge of Ukrainian and Russian would be particularly useful. There is an urgent need for bilingual (Polish-Ukrainian) child psychologists in educational institutions. In addition, psychological care is also needed by the employees of these institutions, who are often exposed to stressful situations resulting: 1) with the sheer lack of skills to establish contact with Ukrainian students; 2) with the difficulty in resolving conflict situations between children of the local community and children of refugees from Ukraine. Furthermore, in the case of teaching facilities, the shortage of Polish language teachers worsened after schools were made available to Ukrainian students. In view of the above, in order to improve the quality and conditions of teaching primarily in schools, as well as to quickly resolve conflicts between the native community of Wałbrzych and the incoming community - refugees from Ukraine, the City Hall of Wałbrzych must take a number of urgent actions to support both teachers and students, not only of Ukrainian nationality, but above all of Polish nationality. With another wave of refugees from Ukraine - mainly women with children and the elderly - expected in the autumn-winter period of 2022/23, taking action to adapt the infrastructure and teaching facilities in Wałbrzych's educational institutions to the needs of Ukrainian refugees is extremely important.
Schedule	

Action implementation steps	2023	2024	2025	2026	2027	2028	2029	2030
Gathering of 80 teachers from Wałbrzych educational institutions								
Gathering a group of 65 school psychologists from Wałbrzych educational establishments								
Training 80 teachers to work with students of Ukrainian origin								
Training 65 school psychologists to work with students of Ukrainian origin								
Expansion of teaching staff in 28 educational establishments								
Provision of external psychological support to staff in 28 educational establishments								
Adaptation of the infrastructure of 28 educational establishments								

Action owner	Education and Social Affairs Department

Main stakeholders	Municipal Social Welfare Centre in Wałbrzych Educational institutions
Action benefits	• Improving social inclusion • Increasing teachers' skills
Enabling policies, strategies and actions	• Act of 12 March 2022 on assistance to citizens of Ukraine in connection with armed conflict on the territory of that state (Journal of Laws. 2022 item 583) • Ordinance No. 197/2022 of the Mayor of the city of Wałbrzych of 18 March 2022 on the organisation of assistance to citizens of Ukraine, in connection with the armed conflict on the territory of that country, arriving in the city of Wałbrzych • Rapid Infrastructure Resilience Appraisal & Action Plan project conducted in the city in cooperation with the European Bank for Reconstruction and Development
Result indicators	• Number of educational establishments with adapted infrastructure to accommodate Ukrainian refugees. • Number of trained teachers from Wałbrzych schools to work with foreign-speaking pupils
Potential to develop inclusivity and improve social aspects	• Enabling the economic and social inclusion of Ukrainian refugees in the Polish society. • Capacity building and skill learning of the teachers included in the program.
Potential for the implementation of innovative and smart technologies	• Development of multilingual online tutoring platforms (including Polish culture and history for Ukrainians, Ukrainian history and culture for Poles). • Uploading in-class training subjects within the curriculum, as well as multilingual, on an education platform. • Organizing some same-time training sessions in multilingual as simultaneous viewing of these trainings.
Mapping of risks, challenges	• Dissatisfaction and lack of acceptance of the new situation by Ukrainian refugees. • In the future, cultural and political differences may exacerbate conflicts between the Polish and Ukrainian/foreigner communities. Education of Ukrainian refugees will reduce the risk of conflicts and promote better integration of the city.
Costs	**Pre-investment**: - **Capital expenditure**: PLN 245,600 / EUR 52,700 **OPEX**: PLN 674,700 / EUR 144,900
	Potential forms of savings

	-
Cost calculation	Data source: List of commercial offers of Ukrainian language courses, Regulation of 24 August 2022 on the minimum rates of basic remuneration for teachers - Journal of Laws, item 1798.
	The estimated capital expenditure for the task includes the training of 80 currently employed and 15 new teachers and 65 specialists (including child school psychologists) in the basics of communication in Ukrainian. The costs of courses of a similar nature range from PLN 350 to PLN 2,400, depending on the form and advancement of the course. The average cost of the course was estimated at PLN 1,534 (EUR 330), giving a total of PLN 245,600 (EUR 52,700) for the 160 designated teachers. In addition, the estimated operating costs indicate the expenses associated with hiring 15 new teachers. The average gross monthly remuneration of a teacher was estimated on the basis of the indicated regulation, which regulates the minimum remuneration rates for teachers with a master's degree and pedagogical preparation - PLN 3,748. This is the average of the following values: entry-level teacher - PLN 3,424, appointed teacher PLN 3,597, certified teacher PLN 4,224. The total annual expenditure was estimated at PLN 674,700 (EUR 144,900).
Financing mechanisms / source	1. *National Reconstruction Plan* • A3.1.1 Support for the development of modern vocational education, higher education and lifelong learning, grants, • A4.1.1. Investments in support of the reform of labour market institutions, grants, • A4.3.1. Investment support programmes enabling the development of activities, increasing participation in the provision of social services and improving the quality of reintegration in social economy entities, grant • A4.6 Increase in labour market participation of certain groups through the development of long-term care, grants. 2. *Own funds of the city*
Impact on the implementation of the sustainable development goals	

M4 Improving the efficiency of private and public care infrastructure			
Timescale	**Sector**	**Type of action**	**Objectives/ priorities**
2023-2030		Enabling action	C4 - Provision of accessible, high-quality services, social and housing infrastructure
Description and scale of action	As part of the action, there are plans to establish an integrated social welfare centre, which will coordinate the implementation of prevention, education and information programmes for residents in cooperation with local medical facilities, e.g., through mobile medical facilities or school campaigns. An important aspect of the action is to support people from vulnerable groups, including but not limited to people with disabilities and those requiring extra care through involvement in health programmes. The integrated social welfare centre will support actions consisting of: • Supporting the implementation of the "Assistant to the Disabled" programme for the provision of assistant services in performing activities of daily living, moving around the city, shopping, dealing with official matters, using cultural goods, etc.; • The creation of support units for people experiencing violence; • Operation of a complex of rooms for people with addictions, the homeless, etc. - centralisation of dispersed services; • Creation of a meeting place for all those interested in animating local life; • Providing short-term care places (2-4 h) for mothers with children - places where mothers can leave their children while, for example, medical appointments; • Providing activity places for the elderly and sheltered housing and support places for elderly people who require assistance but are still managing to live independently; • Provision of sheltered and supported housing for people with disabilities, dependents, young people at risk of social exclusion (housing and psychological support) • Creation of a specialised respite care place for people caring for people with disabilities (care place for a few hours as well as for e.g., a week). In addition, the new facility will collaborate with local health and educational units by supporting other alternative community initiatives in the city, which should include, but not be limited to: • Implementation of a papillomavirus (HPV) vaccination programme - twelve-year-old girls will be included in the programme. In addition, educational campaigns will be carried out in schools to cover all students, parents and teachers. • Continuation of the school dentistry programme - currently there are 6 dental surgeries in schools. Ultimately, there should be dental surgeries in at least every primary school.		

<table>
<tr><td></td><td>

- Implementation of a melanoma education programme, which should be conducted in all schools. Both pupils and school staff should be educated.
- Support and further develop existing actions in schools, such as hippotherapy, physical rehabilitation and sensory integration.

</td></tr>
<tr><td>Background and justification of action</td><td>

An analysis of health care in Wałbrzych indicates moderate accessibility to medical services in the city. It is desirable to increase the number of staff or medical facilities, or at least contracts that increase the pool of available visits. It would be desirable to increase accessibility to specialised medical services, which currently require visits to larger urban centres.

In 2021, the city joined the Ministry of Family and Social Policy's Programme "Personal Assistant for the Disabled - 2021 edition". The programme aimed to provide support to people with disabilities in performing daily activities and in functioning in social life. There is a need to continue this programme in the city.

The city of Wałbrzych actively supports cancer policy in Poland and runs a prophylactic vaccination programme against human papillomavirus (HPV) aimed at girls of the 2007 birth cohort. Also in Wałbrzych's schools, educational lessons were conducted for students of the 2007 birth cohort as part of the HPV vaccination programme. All classes were conducted by qualified medical personnel.

The city of Wałbrzych is planning to extend preventive and dental care to all children and young people living in the Wałbrzych municipality through the implementation of a comprehensive school dentistry programme.

</td></tr>
<tr><td>Schedule</td><td>

Action implementation steps	2023	2024	2025	2026	2027	2028	2029	2030
Creation of an integrated social assistance centre								
Provision of equipment, staff and qualified specialists								
Implementation of preventive, educational and informational activities for residents								

</td></tr>
<tr><td>Action owner</td><td>Education and Social Affairs Department</td></tr>
<tr><td>Main stakeholders</td><td>Municipal Social Welfare Centre in Wałbrzych

Health centres in Wałbrzych</td></tr>
<tr><td>Action benefits</td><td>

- Supporting vulnerable groups in the city: people with disabilities, the elderly, mothers with children, people experiencing violence
- Improving health and social care for residents
- Improving accessibility to health services

</td></tr>
</table>

Enabling policies, strategies and actions	• Strategy for Solving Social Problems of the city of Wałbrzych for 2021-2025 • Action Programme for Disabled Persons of the city of Wałbrzych for 2022-2024 • Programme of Corrective-Educational Actions for Persons Abusing Family in the years 2021-2025 • Family Support Programme of the city of Wałbrzych for 2022-2024 • Prophylactic vaccination programme against human papillomavirus (HPV) aimed at girls born in 2007 • Resolution No. LI/645/17 of the Wałbrzych City Council of 21 December 2017 on the continuation of the "Wałbrzych preventive dental care programme preventing the development of dental caries and periodontal diseases in children and young people from Wałbrzych primary schools and junior high school classes, 2018-2022". • Related to the social objectives of the Territorial Just Transition Plan: "support services for people excluded or at risk of exclusion, affected by the negative effects of transformation"; "support of infrastructure for education and social exclusion: development of assisted and sheltered housing infrastructure, development of de-institutionalised forms of care for dependent persons".
Result indicators	• Number of completed prevention, education and information programmes for residents
Potential to develop inclusivity and improve social aspects	• Increased accessibility to health care and care providing facilities (e.g., Specialized Support Center for violence victims, Center for Addiction Medicine, Shelter for the Homeless, Short-term Childcare Center, Respite Care Center). • Better quality of health care facilities. • Ensuring balanced participation of representatives of all genders in the process of developing and implementing the action. • Increased awareness of various health problems that will lead to more active participation of citizens in prevention and early detection of the condition. • Introduction of a personalized support program for the persons with disabilities in health care and social welfare facilities (type of assistance to be provided can vary from support in commuting, in administrative procedures, shopping or other everyday activities).
Potential for the implementation of innovative and smart technologies	• The development of a system for collecting data and corrective indicators for assessing the efficiency of a given medical facility (clinically and economically) • Voice navigation systems to be installed in important public areas (hospitals, public buildings, etc.) for the visually impaired.

<table>
<tr><td></td><td>

- Health On Home applications for the elderly and those with chronic diseases (remote heart rhythm measurement and reporting, equipping fall sensors with smart wristbands, etc.)

</td></tr>
<tr><td>Mapping of risks, challenges</td><td>

- Older people account for 22.9% of the city's total population and demographic projections indicate that the proportion of older people will continue to increase. This can lead to inefficiencies in the social, health and elderly care systems to ensure the safety of those most vulnerable to environmental pressures. Action aims to mitigate this risk.

</td></tr>
<tr><td>Costs</td><td>
<table>
<tr><th>Pre-investment</th><th>Capital expenditure</th><th>OPEX</th></tr>
<tr><td>-</td><td>PLN 25,000,000
EUR 5,368,000</td><td>PLN 10,422,000
EUR 2,238,000</td></tr>
<tr><th colspan="3">Potential forms of savings</th></tr>
<tr><td colspan="3">-</td></tr>
</table>
</td></tr>
<tr><td>Cost calculation</td><td>

Data source: Wałbrzych City Council, Warsaw City Council, Application form for a project submitted in the call for petitions for the list of non-competitive projects planned to be implemented under the Just Transition Fund in areas covered by the Territorial Just Transition Plan.

The capital expenditure assumes the comprehensive construction of a new facility, adapted to the needs of vulnerable groups, which will serve as an integrated social care centre. The building area should be approximately 1,500 m^2. The facility will be suitable for accommodating more than 40 people on a permanent basis and will additionally have the capacity to accommodate around 30 more people who will be able to benefit from so-called day care. There will be separate themed studios, rehabilitation rooms and other areas for providing care to those in need. The adjacent area should be surrounded by greenery, a sensory garden and a rain garden. These areas could be used as a relaxation and family meeting zone. The estimated investment cost will be around PLN 25,000,000 (EUR 5,368,000).

Annual operating costs have been estimated on the basis of the city of Wałbrzych Budget for 2022, related to the functioning of the currently existing Municipal Social Welfare Centre. The costs of the task include, inter alia: salaries and derivatives of the staff implementing the tasks, costs of facility maintenance (caretaking, monitoring, cleaning, minor repairs and maintenance), purchases of materials, equipment, printed materials, property insurance - PLN 10,422,000 (EUR 2,238,000).

</td></tr>
</table>

Financing mechanisms / source	1. *National Reconstruction Plan* • D1.1.1 Develop and modernise the infrastructure of highly specialised care centres and other healthcare providers, grants, • D1.1.2. Accelerate digital health transformation processes by further developing digital health services, grants, 2. *European Funds for Infrastructure, Climate, Environment 2021-2027 programme,* • Specific objective 4.5 Ensure equitable access to health care and support the resilience of health care systems, including primary health care, and support the transition from institutional to family and community-based care, o Code 128 Health Infrastructure. 3. *City's own resources.*
Impact on the implementation of the sustainable development goals	

M5 Educational campaigns and programmes to raise awareness among residents			
Timescale	**Sector**	**Type of action**	**Objectives/ priorities**
2023-2030		Enabling action	C12 - Building a strong and informed local community and social activation
Description and scale of action	The action envisages the implementation of campaigns, educational and information workshops, conferences and programmes on environmental protection and health and sustainable living. The action should secure a stable source of funding and prepare a strategy for raising alternative finances for the development of new and existing campaigns. These initiatives should relate to the identified areas: • efficient thermo-modernisation of buildings, • rational waste and water-sewage management, appropriate use of rainwater, • implementation of blue-green infrastructure solutions, • circular economy, • promoting pro-ecological attitudes, as well as increasing public awareness of the effects of climate change. In addition, the action would include the implementation of prevention and education programmes in schools in the field of social integration, counteracting violence (including cyberbullying), or programmes making residents aware of support in inconvenient situations for people at risk of depression or addiction. Implementing training courses, competitions and campaigns in educational establishments with the aim of developing in students' habits of saving water, electricity, heat and segregating waste. It is envisaged that approximately 200 information and prevention projects will be implemented (conferences, trainings, workshops, seminars, events, staff training and prevention programmes in educational institutions, social actions in the city related to the implementation of campaigns, conferences or workshops) for about 15,000 participants in the period up to 2030.		
Background and justification of action	The city's actions include educational programmes covering the topic of waste segregation, visits to Selective Waste Collection Points and meetings with the Mayor on water and energy conservation. One of the priorities of the local educational policy for the 2022/2023 school year is the implementation of educational actions aimed at shaping in students the habits of saving water, energy, heat and segregating waste, which, in addition to educational campaigns and training, also provides for the involvement of the community in undertakings organised by the municipality, i.e. cleaning the city, planting ivy, participating in meetings with specialists on health and health prevention. Prevention and education programmes in schools on social inclusion, anti-violence and support in difficult situations for people at risk of depression or addiction are implemented. Educational campaigns are conducted in the city, raising residents' awareness and activation in pro-environmental initiatives, such as:		

- The annual local action entitled "Clean Wałbrzych",
- “Stop Plastic” campaign. The city of Wałbrzych introduced the “Stop – Plastik” campaign on 1 May 2019, which completely banned the use of disposable plastic packaging, dishes and cutlery in city institutions. The action has been a significant success and is inspiring more institutions and companies in Wałbrzych to take action to reduce the use of single-use plastic products. The positive reception and involvement of the community create potentially good conditions for more similar events in the city.
- Organising environmental picnics and "Clean and Green Wałbrzych" events, involving cleaning up and planting trees and shrubs,
- Meetings in the framework of "civic cafes", during which discussions are held about ecological solutions that can be implemented by residents as part of protecting and caring for the local environment.

The action aims to extend and support these activities.

Schedule

Action implementation steps	2023	2024	2025	2026	2027	2028	2029	2030
Analysis of areas in need of training and education								
Planning a programme of campaigns and educational actions in the city								
Implementation of educational and awareness-raising campaigns								

Action owner

Education and Social Affairs Department

Main stakeholders

Municipal Social Welfare Centre in Wałbrzych

Revitalisation Department

Environment and Climate Department

Municipal Office of Buildings

Municipal Utilities Company

Action benefits

- Raising public awareness of environmental and health issues
- Support in difficult situations for people at risk of depression or addiction

Enabling policies, strategies and actions

- Local education policy for the school year 2022/2023
- The "Stop - Plastic" programme
- "Programme of cascade training for employees of local authorities in the field of design and management of greenery in cities" subsidised by the National Fund for Environmental Protection and Water Management.

<table>
<tr><td>Result indicators</td><td colspan="3">• Number of new educational programmes and campaigns conducted
• Number of continued (or expanded existing) educational campaigns in the city</td></tr>
<tr><td>Potential to develop inclusivity and improve social aspects</td><td colspan="3">• During the development of campaigns, diversity of the recipient groups should be taken into consideration, such as age, gender, educational background, disabilities, minorities.
• Economic benefits that will result from responsible use of resources and lower utility bills, especially for economically vulnerable households.</td></tr>
<tr><td>Potential for the implementation of innovative and smart technologies</td><td colspan="3">• Creation of a website and a service providing information on educational campaigns and programmes, as well as a forum for the exchange of experience, information and good practice, and an online grants book and a list of services purchased from organisations conducting tasks for the benefit of city residents.</td></tr>
<tr><td>Mapping of risks, challenges</td><td colspan="3">• There is a significant risk in the city related to the low awareness and social activity of the inhabitants and the resulting problems and inappropriate behaviour, such as: the creation of illegal rubbish dumps, the burning of waste in private cookers to heat the building, the unwillingness to use public transport in the city, illegal connections to the sewage network, illegal discharge of sewage into ditches and rivers, lack of selective waste collection, illegal extraction and lack of management of post-industrial waste from private land, etc. Implementation of the action will help to mitigate the identified risks.</td></tr>
<tr><td rowspan="2">Costs</td><td>Pre-investment</td><td>Capital expenditure</td><td>OPEX</td></tr>
<tr><td>-</td><td>PLN 2,400,000
EUR 515,400</td><td>-</td></tr>
<tr><td>Cost calculation</td><td colspan="3">Data source: Wałbrzych City Hall

Capital expenditure represents the cost of implementing 200 initiatives related to the implementation of an education and information campaign, the delivery of relevant training and workshops for the residents of Wałbrzych. The average cost of implementing one such initiative was estimated at approximately PLN 12,000. The total estimated cost of implementation of this action is - PLN 2,400,000 (EUR 515,400).</td></tr>
<tr><td>Financing mechanisms / source</td><td colspan="3">1. National Fund for Environmental Protection and Water Management, LIFE Programme,
2. Provincial Environmental Protection and Water Management Fund,
3. Own funds of the city</td></tr>
<tr><td>Impact on the implementation of the sustainable development goals</td><td colspan="3"> 
</td></tr>
</table>

M6 Development of an environmental monitoring and control system using smart technologies

Timescale	Sector	Type of action	Objectives/ priorities
2023-2030		Capital investment	C2- Implementation of strategies to reduce low emissions

Description and scale of action	The development of modern technologies allows for increasingly better monitoring of the state of the natural environment, which consequently translates into the possibility of identifying threats and introducing solutions that can prevent its further degradation or adaptation to change. One of the effective ways of monitoring and controlling the state of the natural environment is the use of unmanned aerial vehicles (drones) with appropriate equipment. Depending on their needs and purpose, these devices can be used for research, control and intervention purposes. Drones should be used primarily for measurements determining air quality, but also for monitoring illegal municipal waste dumps, the state of high greenery in parks, forests, cemeteries and along roads in the city. The implementation of this measure will allow the creation of a database of hotspots in the city where further action should be taken to prevent pollution of the natural environment and improve the quality of life of the inhabitants. The action envisages the training of 7 staff members and the creation of two additional job positions.
Background and justification of action	Two stationary air pollution measurement stations are located in Wałbrzych. The creation of an air quality monitoring system using drones would make it easier to conduct measurements at various locations without having to install permanent stations. Such a system could be used internally to take measurements at sites of accidents, fires, illegal waste incineration or burning of materials other than suitable fuel.

Schedule

Action implementation steps	2023	2024	2025	2026	2027	2028	2029	2030
Purchase of drones								
Training and employment of staff								
Creation of a database of hotspots in the city and monitoring in the city								

Action owner	Environment and Climate Department
Main stakeholders	Municipal Police Municipal Social Assistance Centre in Wałbrzych Provincial Inspectorate for Environmental Protection in Wrocław. Office in Wałbrzych
Action benefits	• Possibility to do environmental measurements on a larger scale • Creation of an emergency measurement system regardless of the location • Improvement of air quality through increased control of emitters

<table>
<tr><td>Enabling policies, strategies and actions</td><td colspan="3">• Environmental Protection Programme for the city of Wałbrzych - city with County Rights for the years 2016-2019 including the perspective 2023
• Programme Green Wałbrzych 2020
• Municipal Climate Change Adaptation Plan for the city of Wałbrzych
• Low Emission Management Plan for the years 2014-2020 with an outlook until 2030 for 15 communes of the Wałbrzych agglomeration
• Low Emission Reduction Programme</td></tr>
<tr><td>Result indicators</td><td colspan="3">• Number of drones purchased for monitoring the state of the environment in the city [pcs.].
• Number of employees trained/hired to monitor the state of the environment in the city</td></tr>
<tr><td>Potential to develop inclusivity and improve social aspects</td><td colspan="3">• Ensure equal participation of representatives of all genders in the training program.
• An inclusive recruitment process should be applied in all generated new employment opportunities.
• Increased quality of life of the citizens due to reduced air pollution, illegal waste disposal, maintained parks and forests, etc.
• Development of tools to identify and address fuel poverty in the city.</td></tr>
<tr><td>Potential for the implementation of innovative and smart technologies</td><td colspan="3">• The action is based on the implementation of modern environmental measurement systems using smart technologies, which creates enormous potential for innovative solutions.
• Possible development of a database for monitoring the state of the environment in the city.</td></tr>
<tr><td>Mapping of risks, challenges</td><td colspan="3">• Low emissions in Wałbrzych come from the burning of solid fuels, often of low quality, in local coal fired generation units and outdated cookers. Incidents are recorded in the city related to the creation of illegal rubbish dumps, burning waste in private cookers to heat the building. The action will consist in identifying risks and introducing solutions that can prevent further environmental degradation.</td></tr>
<tr><td rowspan="3">Costs</td><td>Pre-investment</td><td>Capital expenditure</td><td>OPEX</td></tr>
<tr><td>-</td><td>PLN 417,000
EUR 89,000</td><td>PLN 182,400
EUR 39,000</td></tr>
<tr><td colspan="3">Potential forms of savings</td></tr>
<tr><td colspan="4">-</td></tr>
<tr><td>Cost calculation</td><td colspan="3">Data source: Wałbrzych City Hall, 'How to buy drones and drone services in public procurement - a handbook on unmanned aerial vehicles (drones) in local government units', Public Procurement – Water Poland Authority, CIRE, Civic</td></tr>
</table>

	Budget of the city of Kielce, Provincial Fund for Environmental Protection and Water Management in Wrocław.
	Capital expenditure includes the purchase of 3 unmanned aerial vehicles (drones) for monitoring and controlling the state of the quality of the natural environment in the city. Costs include the delivery of drones together with the relevant accessories (control apparatus, gimbal, appropriate air quality monitoring equipment, cost of warranty, servicing, thermal and optical camera, laser scanner, software measurement detectors, initial training and flight simulator) - PLN 417,000 (EUR 89,000). Operational costs, on the other hand, include estimated annual expenditures associated with conducting a pilot monitoring and control mission of air quality and the state of the natural environment in the city once a month (PLN 3,600) - PLN 43,200 (EUR 9,200). Implementation of the action also requires the employment of 2 new employees to operate the equipment. According to the Central Statistical Office in Poland, the average monthly salary in local government administration is around PLN 5,800 - PLN 139,000 (EUR 30,000).
Financing mechanisms / source	1. *National Reconstruction Plan* • A2.3.1 Develop and equip centres of competence (specialised training centres, deployment support, monitoring centres) and infrastructure for the management of the unmanned vehicle industry, as an Ecosystem of Innovation 2. *National Fund for Environmental Protection and Water Management* 3. *Provincial Fund for Environmental Protection and Water Management* 4. *Loans, credits, green bonds,* 5. *Own funds of the city.*
Impact on the implementation of the sustainable development goals	

M7 Creating a network of links of tourist attractions in the city			
Timescale	**Sector**	**Type of action**	**Objectives/ priorities**
2023-2027		Capital investment	C4 - Provision of accessible, high-quality services, social and housing infrastructure
Description and scale of action	The action aims to create a convenient and effective network system for the city's tourist attractions, which will result in more tourists and visitors to the attractions by enabling, for example, well-connected one-day tours. The action proposes connecting (e.g., Książ Castle) with other attractions (e.g., Willa Daisy, Palmiarnia, Old Mine, Porcelain Museum) by implementing a pilot program to create a bus line between these facilities, using hydrogen-powered buses. This will reduce car traffic in the city and intensify the use of low emission means of transport, which will result decrease in air pollution from this sector. The action would also include the implementation of a feasibility study for the construction of a gondola lift connecting, where possible, the city's tourist attractions; Książ Castle, the Old Mine Museum, the Palm House and Aqua Zdrój. The gondola lift is to play a transport function, but also be a tourist attraction, additionally encouraging to visit the city. It is also possible to connect by rail the attractions inside the Książ Landscape Park, where the Książ Castle, the Stary Książ, and the Hochberg Mausoleum are located. It is also important to focus on existing trails in the city, signposting them consistently and conducting marketing activities to promote them. For this purpose, there will be a development of the analysis of existing routes along with the preparation of a technical design as part of the measure. In working on these documents, four areas will be considered in particular: tourism, nature and ecology, education and recreation. Additionally, as part of the previous action of the GCAP, promotional campaigns will be undertaken regarding tourist attractions in the city through educational and information campaigns.		
Background and justification of action	The city has trails: mountain (76.3 km), walking (57.7 km), didactic (12.5 km), cycling (109.4 km), which offer potential for their expansion and cohesion. No statistics are kept on the visiting of the town by tourists, but the most popular attraction, Książ Castle, was visited by nearly 400,000 tourists in 2021, and the second largest attraction, the Old Mine, was visited by 271,444 tourists. The implementation of the action will result in a greater influx of tourists to the city, which will translate into economic benefits, but also into an improvement in the situation of individual attractions included in the network and the attractiveness of the city.		

Schedule	**Action implementation steps**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
	Implementation of a pilot program to create a bus line (using hydrogen buses) between tourist facilities								
	Preparation of a feasibility study for the construction of a gondola lift connecting the largest tourist attractions in the city								
	Development of existing tourist routes in the city								
Action owner	Education and Social Affairs Department								
Main stakeholders	Department of Investments Department of Education and Social Affairs Road, Communication and City Maintenance Authority in Wałbrzych Transport and Road Traffic Department Revitalization and Spatial Planning Department Local Tourist Organization Wałbrzych Agglomeration								
Action benefits	• Increasing the city's tourist attractiveness • Development of cultural heritage • Improving air quality in the city								
Enabling policies, strategies and actions	• Development Strategy of the Wałbrzych Agglomeration with a perspective until 2030 • Plan for Sustainable Development of Public Transport for the Wałbrzych Commune (updated, 2021) • Related to the spatial objectives of the Territorial Just Transition Plan: "thematic tourist routes and tourist products, referring to historical, cultural, natural values as well as tangible and intangible heritage".								
Result indicators	• Creation of a coherent transport network between the most important monuments and attractions in the city • Length of modernised existing tourist routes in the city [km]								
Potential to develop inclusivity and improve social aspects	• Creating tourist transportation that is user friendly and inclusive, especially for people with disabilities, the elderly and parents with children. • Economic benefits from the increased tourism potential of the city. • Generate new jobs to support tourism in the city.								
Potential for the implementation of	• Creation of a mobile app and dedicated website to track tourist routes, opening hours of attractions and their offers, as well as the history of individual places. One of the possibilities of the application can be that								

<table>
<tr><td>innovative and smart technologies</td><td>tourists collect points while visiting the city or use green transports, which they can later transform in vouchers to consume in local shops or restaurants.
• Providing audio promotions with professional guides in a multilingual YouTube application with QR code reading to be placed in front of touristic POI points.</td></tr>
<tr><td>Mapping of risks, challenges</td><td>• The development of bus lines (with the use of hydrogen buses) connecting tourist attractions in Wałbrzych may ensure the effective implementation of zero-emission propulsion for part of the city's fleet and counteract the risk of low-efficiency use of low-emission buses in the city.</td></tr>
<tr><td>Costs</td><td><table>
<tr><th>Pre-investment</th><th>Capital expenditure</th><th>OPEX</th></tr>
<tr><td>PLN 1,750,000
EUR 375,800</td><td>-</td><td>-</td></tr>
<tr><th colspan="3">Potential forms of savings</th></tr>
<tr><td colspan="3">-</td></tr>
</table></td></tr>
<tr><td>Cost calculation</td><td>Data source: Wałbrzych City Hall, Projects implemented by Arup.

Pre-investment costs are the cost of developing a feasibility study for the construction of a gondola line in the right location connecting selected tourist attractions - PLN 1,500,000 (EUR 322,000). Additionally, an analysis of tourist routes in the city will be prepared together with a technical project regarding their modernization and proper marking - PLN 250,000 (EUR 53,600).

The total estimated pre-investment costs amount to PLN 1,750,000 (EUR 375,800).</td></tr>
<tr><td>Financing mechanisms / source</td><td>1. The city's own funds</td></tr>
<tr><td>Impact on the implementation of the sustainable development goals</td><td> 
</td></tr>
</table>

Appendix 2.

Compliance with existing regulations, strategies and development programming documents

Source: City Hall of Wałbrzych

Appendix 2. Compliance with existing regulations, strategies and development programming documents

GCAP is related to the documents in force at the international, community and national level. At the international level, these are primarily conventions and agreements to which Poland, as a country belonging to the European Union, is a signatory. This includes: the United Nations Framework Convention on Climate Change (UNFCCC), the UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP), and the Convention on Biological Diversity (UNCBD).

At the EU level, these are, among others: the European Green Deal (2019), EU Directive 2016/2284 on the reduction of national emissions of certain types of atmospheric pollutants, Directive 2008/50 / EC on air quality and cleaner air for Europe (Directive Moreover, the document takes into account the assumptions included in the 2030 Agenda for Sustainable Development (UN) and the Paris Agreement. medium- and long-term economic policy that responds to the most important challenges of cities through, inter alia, the implementation of low-emission strategies (to increase energy efficiency or improve air quality). Other national documents related to the Green City Action Plan include, among others, the National Development Strategy Regionally until 2030 (NSRR), National Environmental Policy until 2030 (PEP2030), Polish Energy Policy until 2040 (PEP2040).

The Green City Action Plan is in line with the regional and local programs and strategies for sustainable development, improvement of environmental protection and adaptation to climate change in force in the city. Existing links with the documents applicable at the local level are presented below, together with their brief description.

Table 18 Documents related to the assumptions of the Wałbrzych Green City Action Plan

Name	Objectives of the document	Identified connections
The concept of E-Tourism in the Smart City assumption as an opportunity for the development of tourism in Wałbrzych	Recommendation of e-tourism solutions that may be introduced by the local government in Wałbrzych as part of the activities initiated in 2017 for the development of the Smart City concept.	The article is useful for the development of the intelligent component of the GCAP.
Wałbrzych "Smart City" Program	Stressing that the economic success of the city and the satisfaction of its inhabitants are not possible without a coherent vision of sustainable development (in the long term) and mutual integration (cooperation) of all systems and processes - infrastructural, organizational and social, as well as setting directions for the improvement and development of urban services, and integration of processes related to city management (supported by the necessary innovative technology).	The action plan is consistent with the main directions and goals set out in the Wałbrzych "Smart City" Program.
Low-Emission Economy Plan for 2014-2020 with a perspective until 2030 for 15 municipalities of the Wałbrzych Agglomeration	Setting the main goals and directions of activities that will reduce the emission of pollutants into the air, including the emission of dust, sulfur dioxide, nitrogen oxides and carbon dioxide, with particular emphasis on areas where the permissible concentrations in the air have been exceeded.	The goals mentioned in the Low-Emission Economy Plan were considered when developing the document, particularly in the field of reducing greenhouse gas emissions, increasing the energy efficiency of buildings and increasing the share of energy and heat from renewable energy sources.

Name	Objectives of the document	Identified connections
The Municipal Plan of Adaptation to Climate Change for Wałbrzych	Ensuring sustainable development and achieving a balanced spatial structure of the city providing residents with appropriate conditions for development, work and rest, as well as for the effective functioning of the city's economy and protection of its residents in the conditions of climate change.	Where applicable, the objectives of the Municipal Plan for Adaptation to Climate Change for Wałbrzych were included in the development of the GCAP.
"Green Wałbrzych 2020" program	Increasing the quality of life in Wałbrzych by 2020 by radically improving the condition of the natural environment in the city.	GCAP is in line with the "Green Wałbrzych 2020" Program and considers the key areas of actions listed in the Program, such as: Bicycle in Wałbrzych, Clean Water, Public Transport, Air, Waste, Green Spaces and Education.
Environmental Protection Program against noise for the city of Wałbrzych	Identifying problems in areas where noise levels exceed acceptable levels and proposing corrective actions.	GCAP is in line with the Noise Protection Program for the city of Wałbrzych and, where appropriate, considers the main objectives set out in the Program.
Environmental Protection Program for the city of Wałbrzych - a city with poviat rights for 2016-2019 with a perspective until 2023	Setting the goals and directions of the ecological policy of the city of Wałbrzych and specifying the resulting actions that will improve the living conditions of residents while maintaining the quality of the natural environment in the city.	The document is consistent with the long-term vision, strategic goals and priorities set out in the Environmental Protection Program for the city of Wałbrzych. Moreover, during the preparation of the document, data and general information contained in this Program were used.
Study of the conditions and directions of spatial development of the city of Wałbrzych	Diagnosing and designating areas of revitalization, in which the main problems related to the development of areas, population structure and their potential were identified, as well as conducting a comprehensive assessment of the city's functioning system.	The GCAP actions are in line with the objectives of the Study.
Multiannual Housing Resource Management Program of the Wałbrzych Commune for 2019-2023	Defining the basic directions of activities, the implementation of which will ensure the effective implementation by the city of Wałbrzych of its own tasks in the field of housing resources management.	GCAP is in line with the Housing Resource Management Program of the Wałbrzych Commune and considers, where appropriate, the main directions of housing development.
Municipal Revitalization Program for the city of Wałbrzych for 2016-2025	The overriding goal of the Program is the sustainable development of the area of revitalization of the city of Wałbrzych through activities aimed at its renewal and revival as well as strengthening social integration. On the other hand, the strategic goal is to increase the activity, resourcefulness and sense of shared responsibility among residents, high quality of public space and improvement of living conditions, as well as stimulating personal and economic development.	When preparing the actions, the necessity to revitalize the city of Wałbrzych, and especially the areas indicated in this Program, was remembered.
A project to revitalize the city of Wałbrzych	Revitalization of urban areas in Wałbrzych, promoting sustainable urban development using energy-saving measures and reducing energy consumption.	The document is consistent with the directions of the city in the field of urban regeneration.

Name	Objectives of the document	Identified connections
Strategy for Solving Social Problems of the city of Wałbrzych for 2021-2025	Presentation of the picture of the situation of the inhabitants of Wałbrzych and an indication of the directions of changes in the future, including the definition of strategic goals, the implementation of which will reduce the scale of negative phenomena in the city.	The document considers the problems of the inhabitants of Wałbrzych, especially vulnerable groups, such as the elderly, the homeless, low-income families, foreigners, and the disabled.
The Foster Care Development Program of the city of Wałbrzych for the years 2022-2024	Defining the directions of activities in a three-year perspective and recommendations for activities for the development of foster care in the city of Wałbrzych, as well as defining the directions of development of institutions and organizations operating in the field of helping children and the family.	When creating the GCAP, the issue of foster care was considered.
The program of cooperation of the city of Wałbrzych with non-governmental organizations and entities mentioned in art. 3 sec. 3 of the Act on Public Benefit and Volunteer Work for 2022	The main objective of the Program is to support the development of civil society and to strengthen the city's partnership with non-governmental organizations.	During the preparation of the document, the importance of non-governmental organizations in the life of the city of Wałbrzych was remembered and actions consulted with external stakeholders was made possible.
Program of counteracting domestic violence and protection of victims of violence for the city of Wałbrzych for the years 2021-2025	Reducing the scale of the phenomenon of domestic violence in Wałbrzych through the implementation of activities aimed at providing specialist assistance, especially in the field of protection of people experiencing violence and using violence, as well as conducting preventive activities raising social awareness of the causes and effects of domestic violence.	GCAP considers the importance of the safety of women and men living in the family and in the urban community.
Action Program for Disabled People of the city of Wałbrzych for the years 2022-2024	Defining tasks, the implementation of which may improve the life situation of disabled people, their families and charges in the local community.	The actions and priorities formulated under the GCAP consider the needs of disabled people.
Senior policy of the city of Wałbrzych for 2016-2020	Defining the directions of activities for the elderly, their surroundings and the entire community, which should be undertaken both by the commune self-government and its organizational units, as well as non-governmental organizations.	When developing the GCAP, the needs of the elderly in the city were considered, especially in the case of adapting the city infrastructure to the needs and accessibility of this group of residents. This group is particularly sensitive to climate change and threats in the city.
Family Support Program for the city of Wałbrzych for 2022-2024	Support for families with difficulties in fulfilling the care and educational role, children and adolescents as well as pregnant women and their families by implementing an integrated support system and striving for the return of children staying in foster families to their biological parents.	The document thinks about the role of the family in society.
Program of Corrective and Educational Interactions for Persons Using Domestic Violence for 2021-2025	Teaching people abusing domestic violence abusers, self-control, shaping partnership attitudes and respect for relatives and responsibility for committed acts of violence.	GCAP identifies the needs of residents, also reducing the phenomenon of urban / family violence and increasing the level of safety in Wałbrzych.

Name	Objectives of the document	Identified connections
The Commune Program of Prevention and Solving Alcohol-related Problems and Counteracting Drug Addiction for the city of Wałbrzych for 2022	Limiting the health and social effects of alcohol abuse and the use of psychoactive substances by increasing the level of knowledge and awareness of the inhabitants of Wałbrzych and conducting preventive and therapeutic activities.	When creating the GCAP, the social problem was considered when identifying the needs and actions for the city of Wałbrzych.

7. List of figures, tables and sources

Source: City Hall of Wałbrzych

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