NET ZERO CITIES

EU MISSION PLATFORM | CLIMATE NEUTRAL AND SMART CITIES

# Climate Contract

# Action plan for climate neutrality by 2030

## Warsaw's action plan for Climate Neutrality by 2030

Warsaw

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# Abstract

*The set of information and opinions presented in this document constitute only preliminary analyses for the purposes of preparing the Climate City Contract, in terms of Warsaw's participation in the European Commission's Mission of 100 climate-neutral and smart cities by 2030, and will undergo further evaluation and consultation with key urban internal and external stakeholders. The measures indicated in the document are not binding, define the starting point of the city, and constitute only a description of how to achieve the ambitious reduction target set in the Climate City Contract. The document shows that the city is aware of the risks associated with the climate crisis and the need for innovative, out-of-the-box transformational measures, which can only be achieved through broad collaboration to achieve climate neutrality.*

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# Abbreviations and acronyms

| Abbreviations and acronyms | Definition |
|---|---|
| GUS | Central Statistical Office |
| EU | European Union |
| GDP | Gross domestic product |
| KSE | National Power Grid |
| RES | Renewable energy sources |
| GCCAP | Green City and Climate Action Plan |
| NEEST | NetZero Emission and Environmentally Sustainable Territories |
| MEL | Monitoring, Evaluation, Learning |
| SUMP | Sustainable Urban Mobility Plan |
| CAP | Climate Action Plan |
| RP | Republic of Poland |
| ZONE | Integrated System for Low Emission Reduction |

| | |
|---|---|
| CEEB | Central Building Emissions Inventory |
| EC | European Commission |
| PPP | Public-Private Partnership |
| ESCO | Energy Service Company |
| IPPU | Industrial Processes and Product Use |
| AFOLU | Agriculture, Forestry, and Other Land Use |
| SEAP | Sustainable Energy Action Plan |
| BOPiPK | Air Protection and Climate Policy Department |
| ZWW | Green Vision Warsaw |
| GHG | Greenhouse gases |
| GPC | Global Protocol for Community-Scale |
| CDP | Carbon Disclosure Project |
| WMA | Warsaw Metropolitan Area |
| ZIT | Integrated Territorial Investments |
| SPA2020 | Strategic Adaptation Plan 2020 |
| SOR | Strategy for Responsible Development by 2020 (with a perspective for 2030). |
| UN | United Nations Organisation |
| KOBiZE | National Centre for Emissions Management |
| RED | Renewable Energy Directive |
| BZI | Blue-green infrastructure |
| EPBD | Energy Performance of Buildings Directive |
| GOZ | Circular economy |
| MPZP | Local spatial development plan |
| NBS | Nature-based solutions |
| PEP | National Environmental Policy 2030 |

# 1 Introduction

Warsaw has become a participant in the European Union Mission - 100 Climate Neutral and Smart Cities, which aims to achieve climate neutrality by 2030. Participating in the Mission constitutes a great challenge for the city and a motivation for even more intensive measures than those envisaged so far in Warsaw's Green Vision (Green Cities and Climate Action Plan) - the city's main document describing pathways to climate neutrality by 2050 at the latest.

When joining the EU Mission "100 climate-neutral and smart cities by 2030", Warsaw declared to setting a reduction target of **80% by 2030 for two city districts**. This decision was driven by an awareness of local and systemic possibilities and limitations, which is explained in detail later in the document.

Participating in the Mission and preparing the Climate City Contract, implemented in two selected districts: **Praga-Południe** and **Ursynów** mobilise for implementing innovations and bold solutions that will allow achieving climate neutrality in all key sectors of the city's functioning and that can, once tested in the above-mentioned districts, be implemented throughout the city.

Warsaw has been involved in climate action for many years and it is a member of organisations of cities supporting each other in achieving climate goals (e.g. C40, EUROCITIES, Covenant of Mayors for Climate and Energy, ICLEI).

For Warsaw, joining the EU Mission "100 climate-neutral and smart cities by 2030" constitutes the following step and the logical consequence in its long-standing climate policy as well as an opportunity to bring the existing goals and plans (described in a comprehensive and systemic manner in the Green Vision for Warsaw - the city's main document being a "road map" for achieving climate neutrality) to a very concrete, operational, local level. It also constitutes an opportunity to obtain substantive and financial support for planned and ongoing operations responding to the increasingly urgent climate challenges as well as the needs of the city and its residents in this regard. It provides an opportunity to exchange ideas and experiences, a chance to learn from each other, to prototype, test, and modify specific solutions as well as gather experiences that can be replicated and used on a larger scale. The participation in the EU Mission is an additional incentive to mobilise all possible stakeholders and resources to implement climate actions. This stimulus is particularly significant in the context in which Polish cities operate: the lack of a coherent climate policy, national reduction targets, sufficient financial resources. This situation is now changing, but the Polish government's efforts today will yield tangible results  only in a few years. Meanwhile, with the climate crisis on the rise, cities must already mobilise all their resources to slow down or decelerate adverse climate change.

Warsaw's engagement in the EU Mission "100 Climate Neutral and Smart Cities by 2030" is also demonstrated by the fact that the Mayor of the City of Warsaw is a member of the **Cities Mission Mayors Advisory Group**, a forum of 15 Mission City leaders who will work directly with the European Commission and the NetZeroCities consortium, which supports cities in their activities. The members of the group represent the mission cities before the European Commission by being an advocate for their interests, giving feedback, initiating actions, addressing needs and problems.

This Action Plan is one of the three elements of the Climate City Contract (CCC), alongside the Investment Plan and the Commitments. All three elements are closely interlinked and form a

comprehensive plan to achieve climate neutrality in line with the objective defined in the Climate City Contract.

The measures described in the document are non-binding - they are a description of how to achieve the reduction target set out in the Climate City Contract, together with the estimated costs and results in terms of $CO_2$ reduction. The document shows that the city is aware of the risks related to the climate crisis and the transformative actions needed to be taken by all stakeholders - the identified stakeholders - in a collaborative effort to achieve climate neutrality. The detailing of actions, assigning to them the city units and units responsible for implementation will take place in subsequent iterations of the Action Plan, following internal agreements within the City of Warsaw and after detailed arrangements concerning cooperation with key urban stakeholders and as part of participatory processes involving residents. The feasibility of implementing the actions included in the CCC depends also on the availability of funding and other resources necessary to apply for and implement investment and non-investment projects.

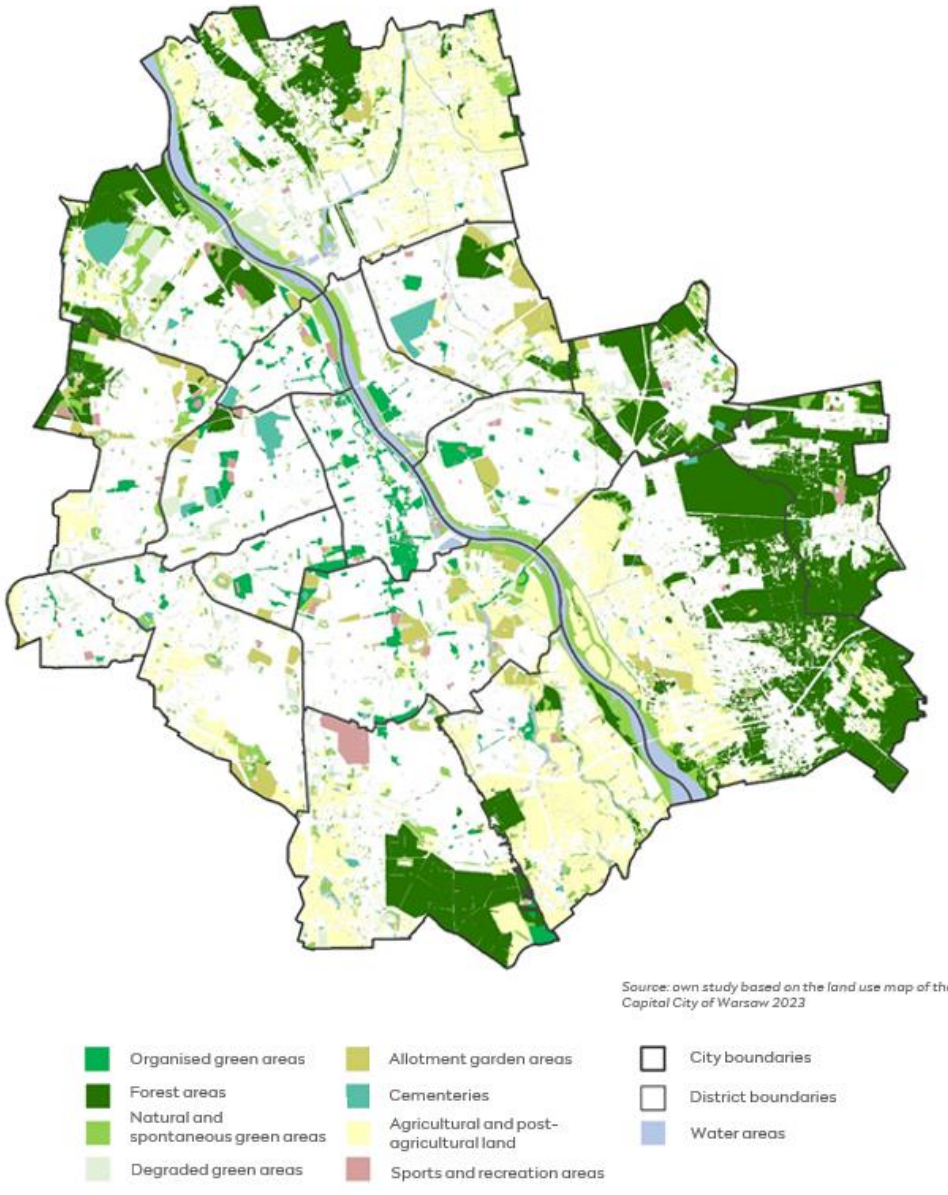



**Figure 1 Plan of the Capital City of Warsaw**

**City characteristics**

Warsaw is the centre of a metropolitan area with an estimated population of approximately 3 million. Year by year, this number is growing. As of 30 June 2023, there were more than 1.86 million people (GUS data) living in Warsaw, which accounted for approx. 33% of the voivodeship's population. 2,243,000 is the median number of people staying in the city per day (excluding transients), including: 1 million 807,000 residents, 378,000 regular visitors (e.g. residents of the metropolitan area). The capital was also visited by 9 million people in 2022 (according to the "Turystyka w Warszawie. Raport 2022"), which adds up to almost 25,000 people per day.

Warsaw is the largest economic centre in Poland and one of the most important economic centres in Central and Eastern Europe. After the Second World War, the city developed into an industrial and service centre, with the expansion of heavy industry being a priority. In the 1990s, the economic structure shifted to the service sector, including educational services as well as the research and technology development sector. At that time, most of the city's industrial production disappeared, and the most efficient and technologically advanced facilities remained. The service sector accounts for 84% of the city's economy, the majority of which consists of financial services. Warsaw occupies the leading position in the EU market in terms of foreign direct investment. The manufacturing sector in the city accounts for only 5% of the GDP generated in the city. The largest employment is observed in the following sectors: trade (more than 20%) as well as transport and storage (approx. 20%).

The economic characteristic of Warsaw translates into the structure of greenhouse gas emissions, in which the emissions of the industrial sector reach a trace level, while emissions from the stationary energy sector (production and consumption of energy in housing and utility buildings) as well as transport constitute almost 99% of the city's emissions (scope 1 and 2).

Warsaw is characterised by a well-developed public transport network, consisting of buses, trams, two metro lines, as well as urban and metropolitan railways. Public transport is used daily by 45 to 55% of Warsaw's residents. In 2023, public transport in Warsaw served 955.8 million people. Cycling is used by 2% of people on a daily basis and the length of cycle routes in the city is 772.2 km. Warsaw also has the Veturilo urban bicycle system, which was used by 4.9 million people in 2023.

Warsaw is located in central Poland, on the Mazovian Plain. It covers an area of 517 km² and is located by the Vistula, the largest of Poland's rivers. The most characteristic natural feature of Warsaw's landscape is the Vistula Valley, protected under the Natura 2000 European nature network. Warsaw is located in a temperate, transitional climate zone. During the year, continental and oceanic air masses flow over the city, resulting in a wide variety of weather conditions.

Urbanised development areas (technical and transport infrastructure, single- and multi-family housing, production and warehousing with accompanying services, commercial and administrative services as well as large-scale retail facilities) cover more than half of Warsaw's area (approx. 53% of the city's area). At the same time, the capital stands out with its relatively high proportion of land with natural functions, which at the end of December 2023 accounted for approx. 47% of its area.

The city is surrounded by extensive, valuable natural and semi-natural areas. These include forests, grasslands, wetlands, and river valleys, and agricultural areas with fertile soils. Together they form the broad Green Ring of Warsaw. It serves the role of a buffer to the sprawling metropolitan agglomeration. It also constitutes a place of rest and recreation for residents. Approximately 43% of these areas consist in the most environmentally valuable lands, covered by various forms of nature

conservation (including a national park, 74 nature reserves, 3 landscape parks, areas belonging to the Natura 2000 network). As much as 27% of the city's area is covered by legal forms of nature conservation. Related areas of high natural value are also located within the administrative boundaries of the capital.

The above conditions make Warsaw a city with great natural potential, favourable for the formation of a blue-green infrastructure system. The highest and high predisposition in this respect is shown by 39% of the areas and moderate by 19%. However, when observing the changes in the functional structure between 2015 and 2023, despite an increase in the area of landscaped green spaces, the city shows a loss in the overall area of land serving natural functions. This results from the development of buildings and, consequently, the loss of woodland, agricultural and former farmland, natural and spontaneous greenery, as well as degraded greenery. This constitutes the result of urbanisation pressures - an increase in the area of residential development, service areas, and transport infrastructure. Therefore, in the area of the blue-green infrastructure, Warsaw needs to increase the level of protection of valuable natural areas, increase the area of urban green space where possible (e.g. through land purchase), improve the quality of urban green space by planting species that provide a wider range of ecosystem services (particularly $CO_2$ sequestration) and plan urban space well, including as many diverse green areas as possible.

As a result of strong and long-lasting urbanisation processes, the hydrographic network within the boundaries of Warsaw is significantly impoverished in relation to its regional surroundings, and therefore comprehensive measures aimed at its protection, restoration, and renaturalisation are necessary. Therefore, it is particularly important to increase rainwater retention capacity within the city.

**Administrative structure**

Warsaw is the capital of Poland and the administrative centre of the Mazowieckie Voivodeship, the largest and most populous of Poland's 16 voivodeships. The decision-making and controlling body consists in the Warsaw City Council, made up of 60 councillors, elected in the course of local elections. The Council constitutes a legislative body. The Warsaw City Council is the decision-making and controlling body and therefore decides on the city's most important matters and supervises the activities of the Mayor. The work of the Council is managed by a chairperson elected from among its members who, together with the vice-chairpersons, forms the Presidium of the Council. The Mayor of the Capital City of Warsaw constitutes the executive body. He manages the day-to-day affairs of the city and represents the city externally.

The powers of the Mayor of Warsaw are relatively large because: he sets and enforces various policies (e.g.: public transport, city roads, public buildings, spatial development, and others), he also controls the budget and revenues in the sectors indicated. The Mayor also implements the resolutions of the City Council as well as the tasks of the city as defined by law. His tasks include in particular: preparing draft resolutions of the city council, drawing up development programmes, determining the manner of implementing resolutions, managing municipal property, implementing the budget, employing and dismissing managers of municipal organisational units. In municipal companies, the Mayor is the entity entitled to exercise shareholder rights.

The Mayor carries out the management through the City of Warsaw, which consists of 40 substantive departments, which are the basic organisational units of the office and cover the entire area of Warsaw. Each department is responsible for a different sector of the city's operations. There are also independent organisational units (sports, cultural, educational, welfare, social assistance,

health care, etc.) and other municipal entities (including municipal companies and companies with municipal participation) within the city structure.

Due to its size and administrative significance, Warsaw performs public administration functions at both municipality and county level. The city is made up of 18 districts, each with its own budget and a district mayor in charge of local affairs, including: housing, education, social welfare, and partly the cultural and sporting activities, as well as green spaces of the respective district.

The districts constitute auxiliary units of Warsaw. The executive bodies in the districts are the district boards, and the legislative and control bodies are the district councils, elected in local elections. The district office constitutes an organisationally distinguished part of the City of Warsaw proper for the district of Warsaw, based in the given district. The work of the district office is managed by the mayor. Sub-level units (housing estate councils, residents' councils) function as auxiliary units in the districts.

Such a complex structure is characterised by a high level of specialisation and a silo manner of operation, in which implementing projects, processes, and operations of an interdisciplinary and systemic nature can sometimes be difficult. Hence the need to set up interdisciplinary bodies within the city to coordinate or manage processes that go beyond narrow specialisation (teams, committees). An example of such a body is the Climate Team, established by the Mayor of Warsaw, which is composed of heads of units of the City of Warsaw and representatives of other municipal entities with the greatest impact on implementing the city's climate policy. The Transition Team working on developing and implementing the Climate City Contract is of a similar nature. It does not yet have a formal character - it will be formally constituted at the stage of implementing the Climate City Contract.

In the Climate City Contract, some of the autonomous municipal entities must be treated as external stakeholders, as they are entities with legal personality and their activities are regulated by laws other than the Municipal Act (e.g. Commercial Companies Code).

Due to the specific structure of Warsaw, which combines two levels of local government (a municipality with the status of a city with county rights), measures developed as part of the Climate City Contract will have to be approved by both Warsaw's authorities, such as the Mayor of Warsaw and the Warsaw City Council, as well as by the bodies of the districts covered by the Climate City Contract: district boards and councils. The competences and tasks of these bodies are defined by the following legal acts and internal regulations: Act of 15 March 2002 on the Capital City of Warsaw System, Statute of the Capital City of Warsaw, and other resolutions of the Warsaw City Council. The specifics and scope of the issues to be addressed by the approval process and the formal classification of the document within the municipal document structure will determine which of them will approve specific plans or actions within the Climate City Contract.

**Key strengths and challenges**

Warsaw is a dynamically developing city of diverse character with a mature market that is attractive to investors (the highest concentration of large foreign investors and the largest Polish companies in the country), a thriving academic and scientific centre and the administrative centre of the country. The city is also characterised by a low level of unemployment, a high level of tourist appeal, as well as ambitious, creative, and well-educated population.

Warsaw is also a city with great natural potential (significant share of green areas in the urban space), with well-developed infrastructure, very good and dynamically developing public transport. It also includes an extensive experience concerning implementing major infrastructure investments as

well as pro-development and social projects taking advantage of EU funds. It also includes extensive experience in the area of creating various forms of public participation and in involving residents in key decisions and activities of the local government (public consultations, workshops, citizens' panel, participatory budgeting). It uses or develops many smart city solutions (e.g. extensive air monitoring system, technology hubs, various forms of innovation and entrepreneurship support, Integrated Traffic Management System, modern 19115 citizen contact platform, e-services, Energy Management System, Smart Heat Network).
Warsaw has the most extensive district heating network in the European Union and the fourth largest in the world. Its length for 2021 was 1,865 kilometres and 18,300 thermal junctions, covering an area of approximately 20,400 hectares. Local heating systems operate alongside the central district heating network. In Warsaw, nearly 80% of its residents take advantage of district heating.

A number of decarbonisation and sustainability measures are also being implemented in the city, such as the development of low-carbon public transport, standards for developing and maintaining green spaces, consistent measures for developing the blue-green infrastructure, support for developing photovoltaics through, among others, the Municipal Photovoltaics Development Fund and a subsidy scheme for residents, a subsidy programme for replacing old furnaces and solid fuel boilers, investments in biogas plants, the Clean Transport Zone and others.

All of these assets will facilitate implementing the Climate City Contract by taking advantage of: the infrastructure in place and existing activities and programmes, the experience gained, the human capital, and the concentration of science, business and key institutions that can directly engage and support the efforts of the city and citizens on the road to climate neutrality.

As with any large metropolis, Warsaw also faces a number of challenges that will affect the implementation of the CCC and must be taken into account during its development and during the planned evaluation and update activities. Some of these relate to development barriers related to the city itself and its functioning, others are related to barriers at a national level. The main challenges concern territorial constraints in terms of developing blue-green infrastructure and urbanisation pressure on green spaces, the lack of a developed network of local and district centres, the dependence on the National Power Grid (KSE) and the national energy mix based on fossil fuels, the limited direct influence of local government on the level of greenhouse gas emissions in the city (approx. 7.5%), the high cost and unknown scale of energy efficiency needs of buildings, systemic barriers (mainly legislative) to RES development, access to finance for transformational measures.

**The scope and reduction target of Warsaw's Climate City Contract**

Warsaw is highly dependent on external factors in its climate neutrality efforts, including the pace of transition away from fossil energy sources at the national level as well as the actions of the private sector and non-local government institutions (more in the Challenges section). Therefore, despite its ambitious aspirations, it has to take into account the existing limitations. Due to this, a selected area of the city - the two districts of **Praga-Południe and Ursynów**, for which greenhouse gas emission reduction targets of **80% by 2030** have been declared in the application for admission to the City Mission. Such an ambitious goal, very difficult to achieve for the entire city, is possible on a more limited scale. Focusing on two districts and the smaller scale of activities will facilitate the involvement of external stakeholders, in terms of Warsaw, in implementing the assumed goal (due to the smaller scale of operation) and will allow to develop cooperation paths that will help, at a later stage, to transform these activities into a system of cooperation on a city-wide level. The reduction

targets for the entire city are set out in the Green Vision for Warsaw (GCCAP): 40% reduction by 2030 and climate neutrality by 2050.

The idea behind preparing the CCC for the two districts was to create so-called local centres (city labs) of climate transformation, progressive areas of the city for testing the possibility of implementing the solutions required to achieve climate neutrality in 2030 across the city. Successful solutions, action paths, innovations, and synergies developed for the districts covered by the Climate City Contract will be analysed on an ongoing basis for applicability in other districts of Warsaw, in order to intensify and complement the implemented decarbonisation measures. The cooperation developed between the city's units, the relationships established with stakeholders, the good cooperation practices in the urban environment, will already be tested and ready for implementation elsewhere.

**Characteristics of the districts covered by the Climate City Contract**

The decision to identify two selected areas of the capital, the districts of Praga-Południe and Ursynów, was made because of their diversity and potential in terms of development structure, transport infrastructure, blue-green infrastructure areas, industrial and service development, as well as power grid characteristics. Their specificity results in that most of the solutions that will be needed for decarbonisation efforts in other districts can be tested in them. Moreover, they include a very similar emission structure in relation to that of the entire city, making them representative for Warsaw as a whole in this respect. Thanks to this, Warsaw has the opportunity to develop diverse innovative solutions in response to the various threats posed by the growing climate crisis, which can be replicated across the city. Other reasons for making this choice included the good cooperation to date, the commitment to climate-neutral activities and the awareness of their importance in the quest for climate neutrality and improving the lives of local people.

Whereas, the specific characteristics for the selected districts indicate the opportunities and constraints associated with operation in each sector.

**Praga-Południe**

**Figure 2 Plan of Praga Południe district**

The district is located within the fabric of the city, among dense, relatively old buildings. It is inhabited by 186,145 people (registered population) and is the second most populous district of Warsaw. It has the highest population density in Warsaw: 8332 persons/km$^2$ (GUS, Panorama dzielnic Warszawy w 2022) and a high proportion of post-working age residents (65+) among the total population (20.1 - 25.0%).

The district has a relatively high proportion of registered cars per 1,000 residents (almost 800). It is characterised by a high rate of new residential development (8.3%) and has a relatively high proportion of parks, greens, and neighbourhood greenery in the district area (14.8%). The district's current buildings are architecturally diverse.

The Praga-Południe district has 10,174 municipal housing units in its stock, with a total area of 399,023 m$^2$. A large part of the premises requires renovation, preparing and implementing which is a long process (several years), especially with the need for deep thermo-modernisation. Carrying out the modernisation requires time due to, among other things, the need to carry out individual energy audits, to produce technical documentation, to obtain approvals and permits, the need to settle claims to properties, to evict buildings for the duration of renovation (which is a lengthy and socially difficult activity, as it often requires the search for replacement premises), to agree with the conservation officer (some buildings are subject to protection). In its stock, the district also includes a considerable number of commercial premises, with a total area of 88,194 m$^2$.

The district is home to the scientific research project NEEST (NetZero Emission and Environmentally Sustainable Territories) funded under the Pilot Cities Programme for Mission 100

climate-neutral and smart cities by 2030 from the Horizon 2020 financial mechanism. It aims to prepare a set of innovative solutions ready to be implemented, scaled and replicated on the basis of model implementation simulations, including technical, financial, and environmental, as well as social and MEL (Monitoring Evaluation and Learning) aspects of deep energy modernisation of buildings and revitalising their surroundings.

**Ursynów**

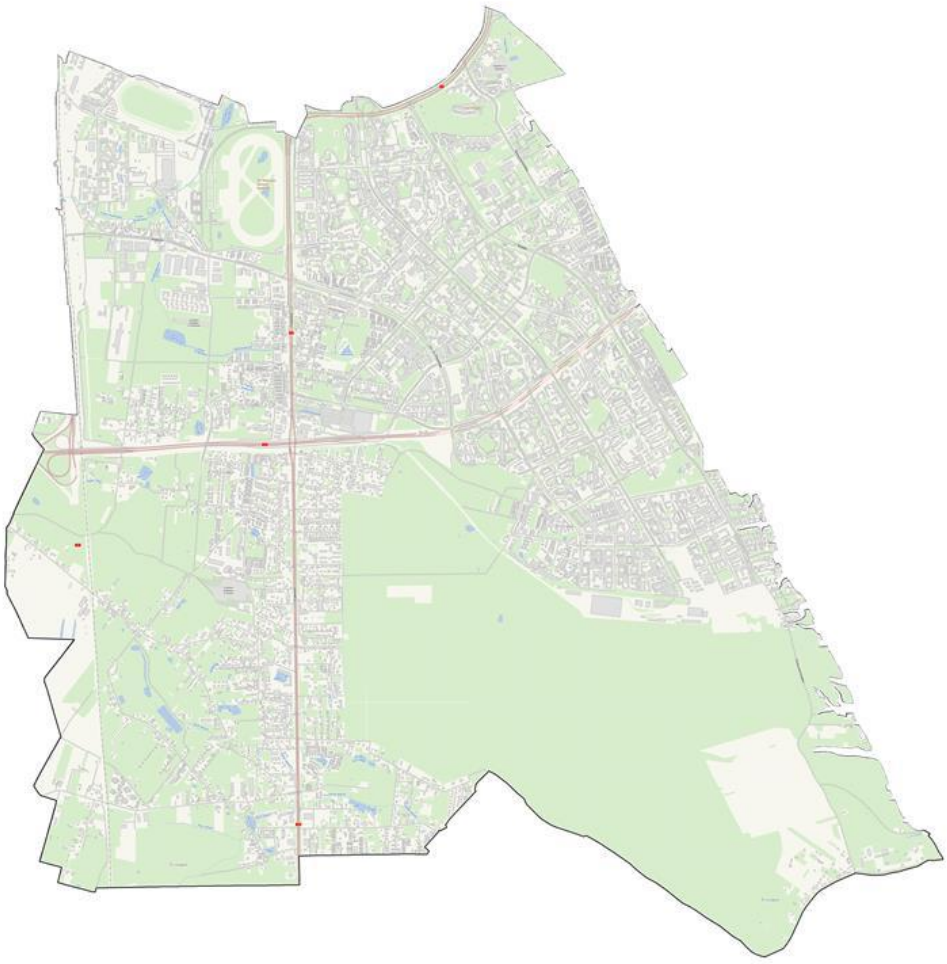


**Figure 3 Map of the Ursynów district**

The Ursynów district is located on the outskirts of the city. It includes a fairly modern, mainly residential building development, also large-scale, with the end of the metro line and a large green area (Las Kabacki nature reserve) surrounding part of the district. The eastern part of the district is dominated by large estates of multi-storey houses built in the 1970s. The western part of the district consists of a small commercial and industrial area and "Zielony Ursynów", a string of former villages with predominantly single-family housing. The district is constantly developing due to its still undeveloped land, attractive location and very good communication with the centre of Warsaw, thanks to the metro line, among other things.

The population is 150,354 (registered population), making Ursynów the fourth most populous district in Warsaw. The district has an average population density of between 3,000 and 4,999 persons/km$^2$ (GUS, Panorama dzielnic Warszawy w 2022 r.). Whereas, it is one of the city's largest districts in terms of area (4,379 ha, or 8.5% of the city's total area). It is also one of the districts with the highest concentration of multi-family housing areas. Ursynów district has a small stock of municipal housing - 494 units with a total area of 23,351 m$^2$ and a small stock of commercial premises (with an area of 3,053 m$^2$).

**Links of the 2030 Climate Neutrality Action Plan to existing climate policies and strategies.**

The overarching strategic document in Warsaw is the **#Warsaw 2030 development strategy**. It is a general document that defines the city's vision, as well as strategic and operational goals. All documents programming the city's development must refer to the #Warsaw 2030 Development Strategy**.** Described under Strategic Objective 3. Functional space, the operational objective 3.2. We live in a clean natural environment contains the following provision: "The quality of the natural environment will be improved by reducing emissions of pollutants and greenhouse gases into the air, including through popularising renewable energy sources and energy-efficient solutions. Operations in favour of climate protection and adapting the city to climate change will be carried out."

Currently there are works being carried out to update the document, including making climate issues a higher priority by including them in the Strategy as a separate strategic objective or at least as a specific operational objective.

**The documents guiding the climate policy of Warsaw**

In the Capital City of Warsaw there are three main documents outlining climate policy and operation in favour of sustainable development:

1. **Green Vision for Warsaw (GCCAP - Green Cities and Climate Action Plan)** - a "road map" containing the city's reduction goals and a description of measures for achieving them, as well as an action plan for a sustainable city, adopted by the Warsaw City Council in 2023.

2. **Climate change adaptation strategy for Warsaw by 2030 with a perspective to 2050. Municipal Adaptation Plan** - a document defining the city's policy aimed at preparing and adapting Warsaw to progressive climate change, constituting the policy of Warsaw in terms of taking action to prevent and mitigate the negative effects of climate change. The document describes the key threats resulting from climate change and the associated risk areas for Warsaw and its residents, as well as indicates courses of action through which the City will protect itself against the negative effects of climate change-related phenomena. The city is currently preparing for an evaluation process concerning the document, which will result in making proper adjustments, developing implementation programmes, and creating a monitoring system.

3. **Environmental Protection Programme** - this is an executive document for the #Warsaw 2030 Strategy (relating to operational objective: 3.2. We live in a clean natural environment), containing a diagnosis of the environment's state, operational objectives, a description of the areas of intervention and the actions that the city must take to protect the environment (its quality, functions), including climate protection. Work is currently underway concerning a new programme up to 2030, in which the planned measures will be compatible with those described in the Green Vision for Warsaw and the Climate City Contract.

The city also includes, or is in the process of developing, documents that are strongly linked to climate policy in their area of influence:

4. **Sustainable Urban Mobility Plan for the Warsaw Metropolis 2030+ (SUMP)** - a document having the character of a long-term, coherent transport development plan for the area of the Warsaw metropolis - 70 communes and 9 counties with a total area of 6,000 km$^2$, with more than 3 million inhabitants. The SUMP includes specific objectives aimed at reducing the negative impact of transport on people and the environment. One of its horizontal objectives (Horizontal Objective II) consists in reducing the environmental and climate impact of transport: "aiming for climate neutrality no later than in 2050, points to the need to reduce emissions from transport in the MW by nearly half already in 2030 (compared to 2019 levels) and a decrease of at least two-thirds thereafter compared to 2030 values. This will be done through extensive sustainable mobility measures, which are linked to the Transport Sector Action Plan.

5. **General Plan** - a master planning and development document under development with which the compatibility of local plans and zoning decisions will be examined. This will be a document containing only the basic arrangements allowing the municipality to plan for sustainable and harmonious development. Until 2023, the binding document that regulated spatial planning and development was **the Study of Conditions and Directions for the Spatial Development of Warsaw** (Studium uwarunkowań i kierunków zagospodarowania przestrzennego Warszawy). The new Study was prepared in 2023, but, due to legislative changes introduced in 2023, it did not become effective, as the Land Use Studies were, by law, replaced by so-called general plans. The General Plan, together with the Development Strategy Warsaw 2040+, is going to determine the direction in which the city will develop over the next twenty years. It will be highly relevant to the measures planned in the Climate City Contract in the sector of blue-green infrastructure development and in the area of (newly constructed) buildings.

The most comprehensive document describing climate policy goals and actions for achieving them is the **Green Vision for Warsaw (GCCAP - Green Cities and Climate Action Plan).**

It combines two methodologies used around the world: the Green City Action Plan, developed by the European Bank for Reconstruction and Development, and the Climate Action Plan, developed by the C40 Cities Climate Leadership Group. Combining these two methodologies allowed producing a document that is comprehensively based on verified data.

We perceive the Climate City Contract as an acceleration of implementing the Green Vision of Warsaw (GCCAP) for the two districts and as an opportunity to bring the city-wide goals and measures contained in the Green Vision of Warsaw to the local and maximally operationalised level. It will be valuable to learn lessons from their implementation for the city as a whole in order to implement the extended scenario described therein, as well as to adopt new, even more ambitious assumptions by 2030. Implementing the Climate City Contract with its ambitious reduction target for two large districts of Warsaw will also constitute a significant contribution in terms of reducing greenhouse gases on a city-wide scale. That is why we consider the CCC as a process to accelerate and intensify the implementation of the Green Vision for Warsaw (GCCAP) for the two districts that are laboratories for change, for which the proposed actions will achieve a reduction in line with the Mission's targets - 80% relative to the base year.

Therefore, the Action Plan is strongly linked to the actions and goals described in the Green Vision for Warsaw. It is also (in the case of existing documents) or will be (in the case of modified

documents) consistent with other urban strategies and policies. In order to ensure the coherence of the main municipal documents, it is planned to evaluate them from this point of view.

The Green Vision for Warsaw (GCAAP) identifies 3 climate scenarios for the entire city:

1. **A business-as-usual scenario**, taking into account the "no additional climate action" emissions projection, which is a scenario that serves as a baseline and comparison for the planned actions.
2. **Reduction scenario**, which defines long-term, achievable goals to achieve the Climate Action Plan - CAP. At the same time, they are linked to the short-term goals of the Green City Action Plan covering a 10-15 year time perspective. This scenario assumes a 40% reduction in greenhouse gas emissions by 2030 as an intermediate target (compared to 2007, corresponding to a 35% reduction compared to 2018) and climate neutrality by 2050, at the latest.
3. **Extended Scenario**, which is potentially possible to be implemented in the city if two conditions are met: the city will operate in favourable political conditions (Poland's climate policy will be developed, enabling Warsaw to meet its ambitious climate targets) and the city will receive sufficient financial resources (national and European) to implement pro-climate measures. This scenario assumes a 60% reduction in greenhouse gas emissions by 2030 as an interim target (compared to 2007, equivalent to 50% compared to 2018).

The applicable scenario for the entire city is the reduction scenario. Whereas, the main task of the Action Plan is to bridge the emission gap between the 40% reduction target by 2030 assumed in the Green Vision for Warsaw and the 80% target laid down in the Climate City Contract, which is more ambitious than the Extended Scenario conditionally adopted in the Green Vision for Warsaw.

This can be mitigated through scaling and new, innovative solutions. Part of the gap can be filled by increasing the scale and intensity of activities described in the Green Vision for Warsaw in the area of the districts covered by the Climate City Contract. The rest will be filled by additional solutions that complement those described in the Green Vision for Warsaw or by finding new synergies between measures that will increase their effectiveness. Some of these measures are planned in a conditional mode, because their implementation depends on external factors (climate policy of the Polish government, legal solutions, available funding, know-how, and technology). Whereas, to bridge the potential gap between emission reductions of up to 80% and net climate neutrality, the efficiency of natural $CO_2$ sequestration will need to be increased (through selecting vegetation and increasing areas of blue-green infrastructure) and consideration will need to be given to geological sequestration, the application of which is going to depend on the emergence of new, more efficient, and cheaper technologies. The last resort will be the purchase of carbon credits - certificates confirming the reduction of greenhouse gases by investing in an environmental project, if possible located in Poland. However, the issue of purchasing carbon credits must be analysed by the city's legal and accounting services to ensure that they comply with the regulations governing local government.

**Developing the Action Plan and following steps of work**

The Action Plan was developed on the basis of the results of the Economic Model, the actions planned in the Green Vision for Warsaw and stakeholder consultations. The consultations took place in terms of the Transition Team, which consisted of an internal team (representatives of selected cells and units of the City of Warsaw) and an external team (city stakeholders). Developing the document was preceded by consultations and workshops with stakeholders, as well as

workshops and meetings between cities participating in the Mission of 100 Climate Neutral and Smart Cities by 2030 as well as representatives of ministries key to implementing the climate policy in Poland within the National Cooperation Platform. The actions described therein are reflected in the Investment Plan and form the basis for defining the City's and stakeholders' Commitments.

**The Climate Policy Department,** operating within **the Air Protection and Climate Policy Department of the City of Warsaw, is responsible for coordinating the process and drafting the document**.

Submitting the Climate City Contract for evaluation will not stop the work on its evaluation and implementation. We intend to continue to meet with representatives of the Government of the Republic of Poland (key ministries for implementing the CCC) in order to identify barriers, challenges, and new opportunities, with a particular focus on raising funding for activities as well as removing infrastructural and legislative barriers, as part of the National Cooperation Platform. In Q4 2024, we are planning the first meetings aiming at acquiring more city stakeholders into the contract and carrying out workshops with stakeholders (internal and external) to look for links and synergies between the actions described in the Action Plan.
In the first quarter of 2025, we plan to organise a meeting of the Internal Transition Team, made up of city officials, employees of city companies, representatives of districts, to jointly analyse the measures contained in the Climate City Contract in terms of gaps and opportunities, and to consider whether additional analyses and studies will be needed concerning its assumptions and the manner in which it is implemented. The next step will be to consult the conclusions of the above-mentioned meetings within the External Transition Team, composed additionally of city stakeholders (contract signatories and other interested representatives of business, science, civil society, public institutions), and to obtain more concrete (at the operational level) commitments from stakeholders concerning actions supporting the implementation of the CCC.

The conclusions of the meetings will be discussed within the Climate Team already functioning within the city and communicated.

We are also planning the following actions:

- **external evaluation** (ex-ante) of the **coherence** of the Climate City Contract with other municipal documents defining or influencing the city's climate policy,
- **monitoring the implementation** of the CCC every 6 months, following a positive evaluation of the document,
- **annual internal evaluation** (mid-term) and, after three years, an external evaluation, concerning the relevance, effectiveness, and efficiency of the planned activities.

Conclusions of the monitoring and evaluation activities will be discussed annually in terms of a Programme Board consisting of the entire Transition Team, with the participation of representatives of the managers of the districts implementing the climate contract and the district councils, representatives of the government and central institutions, representatives of the regional authorities, with the possibility of residents' participation.

The results of the monitoring and evaluation of the Climate City Contract will be presented to the Climate Team. The Team will also be addressed with key implementation findings and needs to support the implementation of activities or adjustments to activities at the strategic level (including updates to the CCC). The team will issue recommendations to the Board of the City of Warsaw

concerning possible CCC adjustments, including additional resources or actions to facilitate, streamline contract implementation, and deal with identified barriers.

Depending on the nature of the recommended decisions or the resources needed for mobilisation, decisions will be taken by the Board of the City of Warsaw, in agreement with the management boards of the mission districts, the Warsaw City Council, or the mission district councils, in accordance with their competences.

The entire management process is described later in this document.

**Key Stakeholders**

Warsaw is strongly dependent on external factors in its climate neutrality efforts, including the pace of transition away from fossil energy sources at the national level, and on the actions of the private sector and non-local government institutions. Key stakeholders for achieving the objectives of the Climate City Contract are:

- **State-owned energy companies (energy producers) and energy distributors**. The rate of decarbonisation of the CHP plants supplying the city with energy to a very large extent is decisive in terms of the rate of decarbonising the entire city. Warsaw's power grid is outdated and in need of modernisation, and requires investment in modern energy transmission management systems and energy storage. The absorption capacity of the grid depends, to a large extent, on the profitability of investing in renewable energy sources in the city. Moreover, the availability of certified green energy to be sourced from the grid now depends, almost entirely, on the policies of energy distributors. Therefore, companies such as Veolia Energia Warszawa, PGNiG Termika, or Stoen Operator are key stakeholders here.
- **The Government of the Republic of Poland and relevant ministries**. Cooperation with central authorities is critical for the success of the Climate City Contracts. The actions of cities are highly dependent on the government's funding policy for local government, the availability of external funds for the transformation, the legislative framework, national energy, and climate policy. The Treasury is also a major shareholder in energy companies. The key ministries for implementing the Climate City Contract are the Ministry of Climate and Environment (in terms of coordinating the CCC with the national climate policy), the Ministry of Infrastructure (in the area of solutions related to construction and transport), and the Ministry of Funds and Regional Policy (in the area of financial support programmes). Currently, cooperation between mission cities and representatives of the central administration is actively developing in terms of the National Cooperation Platform, the aim of which is to discuss ways of the needed support (legislative, financial, technical, etc.) and the necessary interventions at the national level, enabling the CCC to be implemented and systemic barriers to be eliminated. In 2023, discussions between the Polish Mission Cities and ministries, coordinated by the Ministry of Climate and Environment, were initiated with the aim of establishing cooperation to support cities in their quest for climate neutrality. A series of multi-stakeholder meetings involving cities and representatives of several key ministries responsible for the sectors of climate, environment, domestic and foreign funds, development, technology, innovation, infrastructure, energy, etc. began in 2024. Barriers, including legislative, organisational, technical, and financial ones, were discussed during these discussions. A process has been initiated to involve the government side in the Climate City Contracts as a signatory.
- **The National Environmental Protection Fund and other operators of funding programmes** - the deep thermal modernisation of buildings and investments in public transport involve great

costs, so securing adequate funding for local authorities from external sources plays a key role here.

- **The science sector** - reducing the demand for primary energy requires a continuous search for and implementation of innovative solutions in the form of: ways to reduce consumption, energy recovery methods, ways to use waste energy, efficient storage of surplus energy. Therefore, cooperation with universities and scientific institutions in this field, but also in monitoring projects, climate diagnoses and scenarios, as well as social processes, is very important. Involving local communities in climate action, building commitment and ownership, supporting behavioural change, and developing a framework for working with local authorities is crucial to the success of the transition process.
- **Manufacturing, trade, and service companies** - are key players for several reasons: they consume a large amount of energy and have a high potential for reducing energy consumption and using waste energy. Specialised companies - operators of vehicle charging stations as well as companies with large vehicle fleets can have an impact on developing electromobility. The companies also have properties in the mission districts that can be used in terms of efforts to invest in RES, increase energy efficiency, and develop blue-green infrastructure.
- **Municipal companies and units, including districts**. These are the entities responsible for expanding pedestrian infrastructure, cycling and the public transport network, as well as investments in blue-green infrastructure in urban areas. The municipal units and companies constitute also the administrators of the land where much of the transformation work will be carried out. The districts are also in direct contact with residents and a valuable source of information about the situation of the vulnerable and excluded groups they work with on a daily basis.
- **Construction and renovation companies as well as cooperatives and housing associations**. Entities operating in the construction industry and building administrators have a significant impact on developing and implementing new energy standards in new and modernised buildings. Without their commitment it will be difficult to carry out effective activities in this area.
- **Residents.** Because the planned measures will be implemented largely with public money and their effects will affect the quality of life of the residents, they must be involved in the entire process and accept the implemented measures. In particular, they must be consulted on manners of developing public areas, on issues of reducing car traffic and changing transport habits, on measures for increasing the energy efficiency of buildings, on issues of a fair energy transition, and on the protection of vulnerable groups. Residents who know their districts, their problems, and their needs can constitute the source of many important initiatives and ideas to support the implementation of the CCC.

# 2 Part A - Current status of climate action

As Poland's largest city and its administrative capital, Warsaw is aware of its significant role in striving for climate neutrality. The city is home to more than 5% of the country's population (according to the Central Statistical Office for 2022), and an additional 1% are its users - which amounts to approx. 2

million people functioning in the Warsaw area every day. The largest central offices, institutions, headquarters of many national and international companies, as well as institutions are located here. Therefore, the city has a significant share of national greenhouse gas emissions and, as the capital, a major opinion-forming role.

Therefore, Warsaw wants to play a leading role in the region and in the country in striving for climate neutrality, to implement, test, and replicate new solutions and to set trends for other cities in Poland and Europe.
Warsaw has been pursuing a consistent climate policy for many years through the following measures:

- 2007 r. - Warsaw joined the **C40 Cities** association, an organisation bringing together the world's metropolises working together on climate protection. Warsaw is a member of five working groups and a signatory to several agreements and declarations, the implementation of which has had a very positive impact on adaptation and mitigation measures and the quality of life and health of the population.
- 2009 - joining the European Commission's initiative **Covenant of Mayors** - 31 August 2021 the Warsaw City Council has adopted Position No. 37 on a new climate declaration as part of the international initiative "Covenant of Mayors for Climate and Energy". It obliges the Capital City of Warsaw to reduce greenhouse gas emissions in accordance with the goal of achieving climate neutrality in 2050, to increase the city's resilience and adaptation to the adverse effects of climate change, and to combat fuel poverty as one of the key actions to ensure a just transition.
- 2009 - Adopting the **Sustainable Urban Mobility Plan (SUMP)** - the first document of a strategic nature that set out the principles for developing urban transport in a sustainable manner (on 16 November 2023, the Warsaw City Council adopted the new Sustainable Urban Mobility Plan for the Warsaw metropolitan area - SUMP).
- 2011 - Adopting the **Sustainable Energy Action Plan (SEAP)** - aimed at reducing the city's energy consumption and carbon dioxide emissions into the atmosphere by, among other things, increasing energy production from renewable sources.
- 2016 - Adopting the **Environmental Protection Programme** (updated in 2021. A new programme up to 2030 is currently under development), indicating actions aimed at improving the quality of life in the city through sustainable development, preserving the significant values of the natural environment, improving its condition, improving spatial order, and developing environmental infrastructure (equipment, systems, as well as activities aimed at protecting and improving the environment), protecting the climate, and adapting the city to its changes.
- 2018 - Adopting the **#Warsaw2030 Development Strategy -** a general document that defines the city's vision, strategic and operational goals. Work is currently underway to update the document, including making climate protection issues (mitigation and adaptation) a higher priority in the city's strategic objectives.
- 2019 - Adopting the **Climate Change Adaptation Strategy for the Capital City of Warsaw by 2030 with a perspective to 2050. Municipal Plan**, constituting the policy of Warsaw in terms of taking action to prevent and mitigate the negative effects of climate change. The document describes the key threats resulting from climate change and the associated risk areas for Warsaw and its residents, as well as indicating courses of action through which the City will protect itself against the negative effects of climate change-related phenomena.
- 2019 - Establishing the **Air Protection and Climate Policy Department (BOPiPK)**, whose tasks include coordinating the city's climate policy, initiating actions and processes on climate change mitigation and adaptation.
- 2017 - one of the largest municipal companies **Miejskie Przedsiębiorstwo Wodociągów i Kanalizacji** signed the "Charter of Ecological Responsibility of Entrepreneurs and Employers in Poland", whose signatories-initiators are 33 Polish companies and organisations. The document constitutes a voluntary, open initiative including declarations of concrete actions for climate neutrality, environmental education, and the promotion of a circular economy. The company is

consistently implementing decarbonisation measures by investing in renewable energy, energy recovery, and circular economy. In 2023, the company was already one-third self-sufficient in terms of energy.

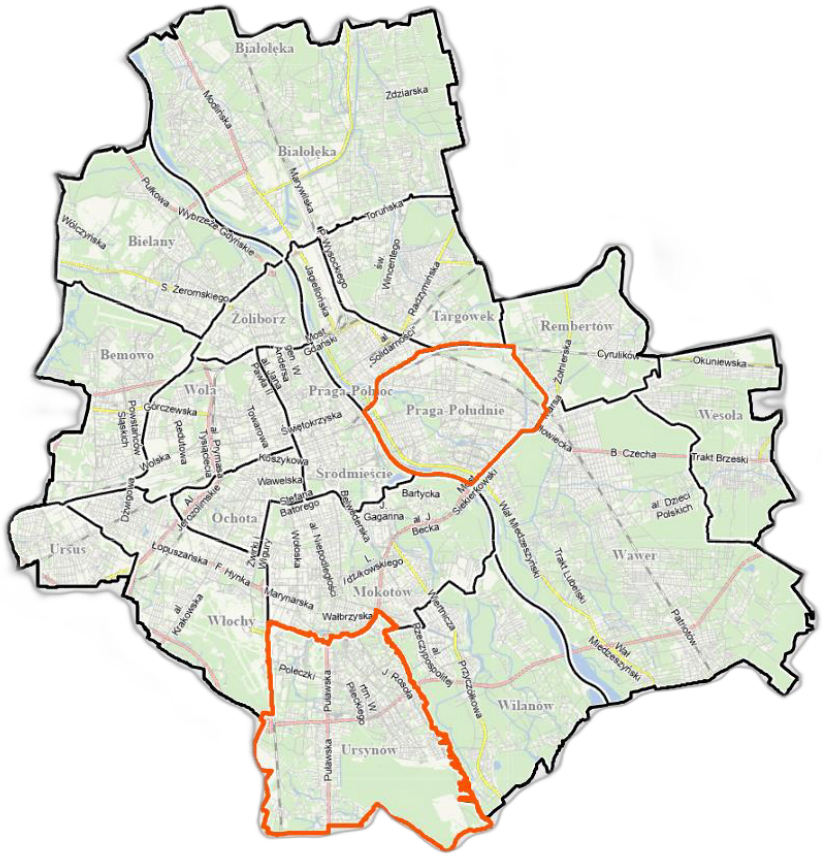
- 2020 - carrying out a citizens' panel called: the **Warsaw Climate Panel.** The aim of the panel was to enable the citizens of Warsaw to participate in the decision-making process concerning increasing the energy efficiency of Warsaw and the share of renewable energy sources in the city's energy balance. A group of randomly selected 90 residents, representative for the city's social structure in terms of age, gender and education, came up with 49 recommendations, which are being implemented by Warsaw on the basis of the Mayor's commitment.
- 2023 - Adopting the **Green Vision for Warsaw** - a document describing how the city can achieve climate neutrality by 2050. It is a comprehensive Green City & Climate Action Plan. It builds on the city's declared levels of greenhouse gas emission reductions and plans to strive for climate neutrality and sustainable development goals, while promoting social inclusion.
- 2022 - application to the European Commission's Mission 100 Climate Neutral and Smart Cities 2030 initiative and to the Pilot Cities Programme within the Mission 100 Cities, receiving a grant and joining **the NEEST - Climate Neutral and Environmentally Sustainable Urban Areas project consortium**.
- 2023 - initiating works on the **General Plan,** which will divide the city into planning zones with specific functional profiles for which basic land use parameters will be defined. Due to legislative changes in Poland, the plan will replace the hitherto binding **Study of Conditions and Directions for the Spatial Development of Warsaw, which sets** the directions for the city's development.
- 2023 - establishing the **Climate Team chaired by the Mayor of Warsaw** - an interdisciplinary team composed of heads of units of the City of Warsaw and representatives of other municipal entities with the greatest impact on implementing the city's climate policy. The task of the team is to coordinate the implementation of projects and processes in the area of mitigation and adaptation, which are systemic and interdisciplinary in nature.
- 2023 - accessing the European Bank for Reconstruction and Development project: **Enhancing City-level Climate Governance: Implementation Plan and Initial Climate Risk Disclosure for the City of Warsaw**, which aims to build awareness and competence in the city' departments and organisational units regarding a better understanding of climate change risks and potential opportunities, to help develop climate proofing processes for city investments and to support the identification of an effective governance model to integrate climate issues into key city management and planning processes (climate governance).
- Since 2007, Warsaw has been carrying out **a GHG inventory** in 2-year cycles. Since 2018, the inventory is carried out in accordance with the requirements of the "GHG Protocol Corporate Accounting and Reporting Standard". The most recent inventory was carried out in 2023 and includes data concerning 2022 emissions.

**Table I-1.1: Climate neutrality targets up to 2030.**

| Sector | Scope 1 | Scope 2 | Scope 3 |
|---|---|---|---|
| **Stationary energy** | Included | Included | None |
| **Transport** | Included | None | None |
| **Waste management** | Included | None | Included |

| | | | |
|---|---|---|---|
| **IPPU** | None | None | None |
| **AFOLU** | None | None | None |
| **Other** | None | None | None |
| **Geographical boundaries** | **Same as administrative boundaries** | **Smaller than administrative boundaries** | **Larger than administrative boundaries** |
| (Mark the appropriate option) | | X | |
| Description of excluded/additional areas | | Two districts of Warsaw: Ursynów and Praga-Południe | |

**Figure 4 Map of the Capital City of Warsaw - location of selected districts: Ursynów and Praga-Południe**



## 2.1 Module A-1 Baseline greenhouse gas emissions inventory

**Baseline greenhouse gas inventory**

Warsaw is developing a greenhouse gas emissions inventory on a biennial basis. It consists of collecting data and counting emissions based on an accepted methodology in line with an international standard for counting greenhouse gas emissions called The Global Protocol for Community Scale Greenhouse Gas Emission Inventories (GPC). All emissions are calculated for three main sectors: stationary energy, transport, and waste. The inventory is in accordance with the requirements of the C40 organisation, by which it is also verified, and constitutes one of the elements of the annual report submitted to the Carbon Disclosure Project (CDP) platform of the Covenant of Mayors in which Warsaw participates. The inventory takes advantage of various types of data obtained from a number of departments and organisational units of the City of Warsaw and eternal entities such as energy companies, municipal companies, technology companies, and also from national databases (e.g. National Centre for Emissions Management, Central Statistical Office). All calculations are collected in the CIRIS tabulation tool, which constitutes the international benchmark application for analysing this data. The results obtained are consulted with technical experts from C40 and form the basis for ensuring that the conditions for the city's participation in the organisation are compatible.

Warsaw has all the data necessary to develop a greenhouse gas emissions inventory, both for the districts covered by the Climate City Contract and for the city as a whole, including at the level of each district. The following gases are analysed: carbon dioxide - $CO_2$, methane - CH4, and nitrous oxide - N2O.

The inventory presents the level of greenhouse gas emissions for a given year for the three main sectors:

1. **stationary energy**, i.e. emissions associated with the consumption of electricity and heat in buildings, machinery and installations, as well as fugitive emissions from the gas network,
2. **transport**, i.e. emissions caused by the movement of cars, trains, buses, trams, metros and aircraft moving within the city's administrative area,
3. **waste**, i.e. emissions associated with the treatment of solid waste and wastewater generated within the city.

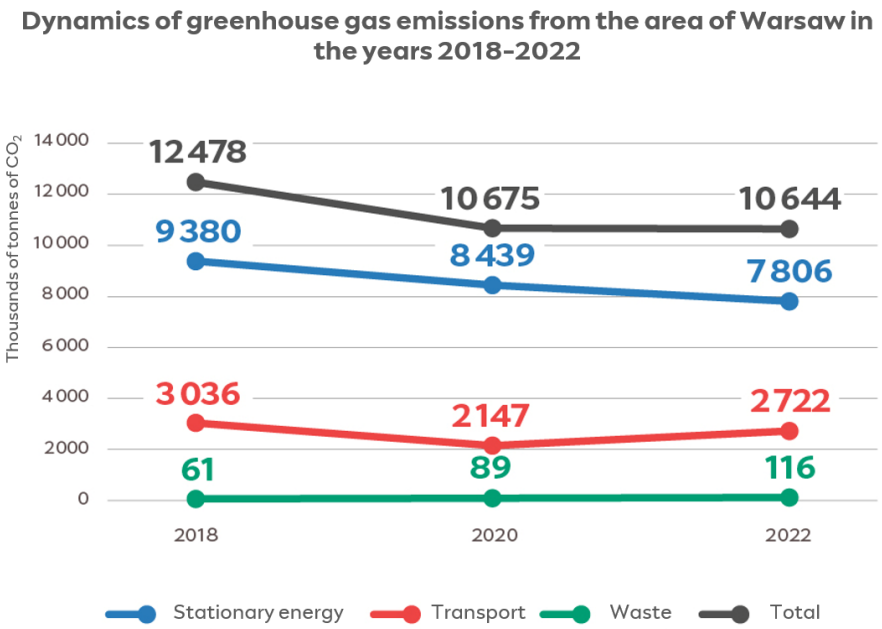
The agriculture, forestry, and other land use (AFOLU) sectors were not included in each of the GHG inventories carried out.

The baseline GHG emission inventory for Warsaw was carried out for the year 2018 and, on its basis, an economic model (an integrated tool supporting the climate transition planning process, enabling data-driven strategic decision-making) was developed for the Climate City Contract. The following GHG inventory results were obtained for the 3 sectors:

Stationary energy - 9,380,016 $tCO_2e$
Transport – 3,036,454 $tCO_2e$
Waste – 61,404 $tCO_2e$
**The total emissions** for the entire area of the City of Warsaw amounted to: **12,477,873 $tCO_2e$.**

The following GHG inventories carried out in 2020 and 2022 showed the dynamics of change for each of the studied sectors, which are included in the graph below:

Figure 5




The increase or lack of reduction in 2022 is, in our opinion, temporary and related to the war in Ukraine, as a result of which Poland, including Warsaw, has become an aid and logistics hub, thereby increasing the number of city users (migrants from Ukraine and people involved in aid to Ukraine) by several hundred thousand. An economic model was also developed for two Warsaw districts, which indicates the following sectoral emissions:

Stationary energy – 1,502,090 $tCO_2e$

Transport – 372,725 $tCO_2e$

Waste - 2023 $tCO_2e$

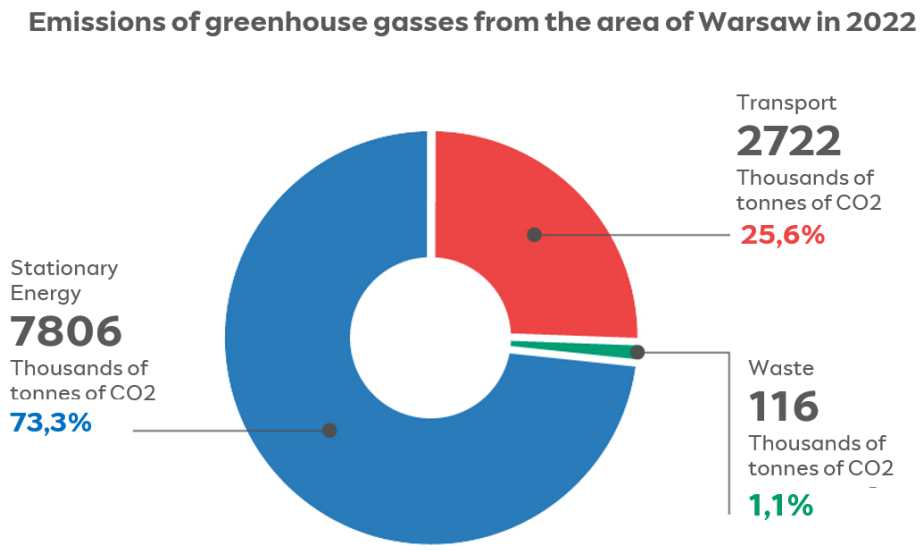
**The total emissions** for the area of the two districts amounted to: **1,883,243 $tCO_2e$.**

According to calculations of the economic model, in order to achieve the reduction goals of the Climate City Contract, it will be necessary to reduce CO2 emissions at **1,599,000 $tCO_2e$**, of which concerning transport – 190,000 $tCO_2e$, buildings and heating – 517,000 $tCO_2e$, electricity – 881,000 $tCO_2e$, waste – 6,000 $tCO_2e$ and other sectors – 6,000 $tCO_2e$.

The greenhouse gas emissions inventory carried out in 2022 showed the following contribution by sector to the city's total emissions:

- nearly three quarters of Warsaw's greenhouse gas emissions result from the production and consumption of electricity and heat by buildings.
- a quarter of the emissions are related to transport - primarily road and to a lesser extent rail, water, and air.
- approximately one % of emissions result from the treatment of waste generated within the city.

Figure 6




As the inventory shows, the greatest potential for emission reductions is in the stationary energy sector and the transport sector. Consequently, the Climate City Contract places the greatest emphasis on actions from these sectors. The waste sector has a minimal impact on the city's carbon footprint and $CO_2$ reduction potential.

The 2018 baseline GHG emissions inventory forms the basis for further analyses of reduction needs within the city. Based on its results, a level of $CO_2$ reduction (reduction effect) has been assigned to each measure described in the Green Vision for Warsaw (GCCAP), providing a reference point for monitoring the progress of reduction measures implemented in the city, in various sectors.

**Methodology for calculating emissions for the activities described in the Action Plan**

All emission reduction calculations have been prepared based on:

- the assumptions of the Green Vision for Warsaw and its reduction goals,
- results of the Economic Model for Warsaw,
- results of the 2018 greenhouse gas emissions inventory for Warsaw for electricity, heat, transport, waste
- results of the heat source inventory for Warsaw,
- assumptions of the Warsaw Green Building Standard,
- analyses of the Public Roads Authority in Warsaw in terms of installing city lighting,
- the city's database systems: the Central Land, Building, and Premises Register, the Building and Premises Inventory and Management System.
- climate change adaptation strategy for Warsaw up to 2030 with a perspective for 2050, the Municipal Adaptation Plan, the Study of Conditions and Directions for Spatial Development of Warsaw.
- studies and articles from online sources concerning estimating $CO_2$ reductions.

For the parts of measures B 2.1 and B 2.2 (share of renewable energy, energy removed/replaced, estimated reduction in GHG emissions, offset GHG emissions), for which no precise data was

available for the districts covered by the Climate City Contract, an indicator based on the percentage share of Ursynów and Praga-Południe (as of 2022) in the total population of Warsaw was used for the calculations. Based on this share, the proportions of emissions per district were calculated. These are as follows: Praga-Południe - 186,623, representing 10% of Warsaw's population, and Ursynów - 151,345, representing 8% of Warsaw's population. In the performed calculations these figures are taken collectively, giving a total of 337,968 representing 18% of the city's total population (the total population of Warsaw as of 2022 was 1,862,000 according to the Central Statistical Office).

**Note:** $CO_2$ reduction calculations have been prepared on the basis of the best available knowledge obtained by the persons preparing the document during its development. Due to the complexity of the measures described in the Climate City Contract and the lack of publicly available, proven methodologies for estimating emission reductions for specific sectoral measures, the calculations will need to be further verified and updated at a later stage.

Calculating $CO_2$ emission reductions for each of the measures described in point B.2.2 has been prepared based on the most up-to-date information available, including the results of the 2018, 2020 and 2022 GHG inventories and available methodologies for counting $CO_2$ emissions for each sector. The resulting total $CO_2$ reduction is close to the estimate of the Economic Model.

For the selected sectors: buildings and heating as well as energy, the calculated values are inconsistent with the Economic Model. This is due to the nature of the Economic Model, which estimated values based on the assumptions entered into it, some of which were based on data obtained from the city and some on averaged indicators. Therefore, its results can be considered as a more large-scale approximation, which was very useful at the start of the work on the Climate City Contract. Whereas, real data was used to calculate the emission reductions for each measure, which enabled a more precise result. These discrepancies will continue to be analysed before the following iteration of the Climate City Contract which will be carried out in the following months.

In addition, the values estimated by the Economic Model have been entered for the AFOLU/IPPU sectors in Table A.1.3. While the greenhouse gas emissions inventory that Warsaw carries out every two years involves calculating the carbon footprint at the Basic level, thus excluding these two sectors. It also does not include the calculation of emissions of gases such as SF6, HFCs, PFCs, or NF3, so these cannot be counted for individual activities. All activities described in detail under the Green Infrastructure and Nature-Based Solutions have been treated as those that can be undertaken under the Agriculture, Forestry, and Land Use (AFOLU) sector.

| **A-1.2: Inventory of emissions in the two districts by source sector** | | | | |
|---|---|---|---|---|
| Baseline year | 2018 | | | |
| Unit | $tCO_2e$ /year | | | |
| | Scope 1 | Scope 2 | Scope 3 | Total |
| Buildings | **610927** | | | **610927** |
| Transport | **372725** | | | **372725** |
| Waste | | | **2023** | **2023** |

| | | | | | |
|---|---|---|---|---|---|
| Electricity | | | **891163** | | **891163** |
| Industry and Industrial Processes (IPPU) and Agriculture, Forestry, and Land Use (AFOLU) | | **6405** | | | **6405** |
| Total | | **990057** | **891163** | **2023** | **1883243** |

| **A-1.3: Activity of the source sectors** | | | |
|---|---|---|---|
| Baseline year | | **2018** | |
| | Scope 1 | Scope 2 | Scope 3 |
| **Sector: Transport** | | | |
| Passenger cars and motorbikes (million km/year) | **1321** | | |
| Buses (million km/year) | **20** | | |
| Trains/metro (million km/year) | **1** | | |
| Light trucks < 3.5 t (million km/year) | **13** | | |
| Heavy trucks >3.5 t (million km/year) | **131** | | |
| **Sector: Buildings and Electricity** | | | |
| Heating demand (space heating + domestic hot water) (GWh/year) | **2725** | | |
| Electricity demand within the city limits (GWh/year) | | **1212** | |
| **Sector: Waste** | | | |

| | | | |
|---|---|---|---|
| Waste collected within the city limits (tonnes) | | | **29919** |
| **Sector: Industry and Industrial Processes (IPPU)** | | | |
| **Sector: Agriculture, forestry, and land use (AFOLU)** | | | |

Warsaw

Action plan for climate neutrality by 2030.

| Sector | Emissions BAU 2030 | (1) Baseline emissions | (2) Emission reduction target 2030 | | (3) Emission reductions in existing action plans, strategies, etc. | | (4) Emission gap | | (5) Reducing emissions through the Climate Contract Action Plan to close the emissions gap | | (6) Residual emissions | | Emission reduction calculated on the basis of the Action Plan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Emissions set for Business as Usual for 2030. | Base issues, preferably no older than 2018. | The emission reduction target for 2030 should achieve at least an 80% reduction compared to baseline emissions, as reported in section 2 of the Climate Contract commitment document. The overall goal should be either a total reduction in greenhouse gas emissions or net zero emissions, which means including offsets for any remaining emissions. | | Emission reductions that would be achieved through existing policies and plans, as outlined in Section A-2.1. By definition, these activities do not constitute part of the portfolio of activities in Section B. If they are fully or partially included in module B-2, their associated reduction potential should be referred to in column (5) and should not be included here.<br><br>WARNING: If the baseline is a business as usual (BAU) scenario and the BAU modelling includes some activities from existing plans, the associated emission reductions should not be included in this column as they would otherwise be counted twice. | | (4) = (2) - (3) | | This column is used to describe the emission reductions associated with the portfolio of activities presented in Module B-2. The effect of these measures should equal the emissions gap. If there is a difference between the reduction potential of the measures identified in Module B-2 (for example because their reduction potential has not been fully estimated, or because additional measures will be identified in future iterations), the Climate Neutral Action Plan should clearly describe the difference and explain how it will be closed. Until this difference is addressed, it will be considered part of the residual emissions. | | (6) = (1) - (2) | | Emission reductions calculated on the basis of the adopted methodologies resulting from the individual actions described in points B.2.1 and B 2.2. |
| | kton | kton | kton | (%) | kton | (%) | kton | (%) | kton | (%) | kton | (%) | kton |
| Buildings | 589 | 611 | 517 | 88% | n/a | | | | 517 | 88% | 72 | 12% | 749 |
| Electricity | 1075 | 891 | 881 | 82% | | | | | 881 | 82% | 193 | 18% | 377 |
| Transport | 312 | 373 | 190 | 61% | | | | | 190 | 61% | 122 | 39% | 247 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Waste Management | 8 | 2 | 6 | 73% | | | | 6 | 73% | 2 | 27% | 6 |
| Industry and Industrial Processes (IPPU) and Agriculture, Forestry, and Land Use (AFOLU) | 6 | 6 | 5 | 80% | | | | 5 | 80% | 1 | 20% | 175 |
| Total | 1991 | 1883 | 1599 | 80% | | | | 1599 | 80% | 391 | 20% | 1555 |

## 2.2 Module A-2 Evaluation of current policies and strategies

**Local level**

**Assumptions to the plan for supply of heat, electricity, and gas fuels for Warsaw (being updated)**

**Territorial scope:** local

**Significance:** Document, adopted on 27 August 2020 by a resolution of the Warsaw City Council No. XXXV/1074/2020, sets out changes to the operation of the energy system in the city, describing the assumptions and possibilities for transforming it into a less carbon-intensive system.

**Description:** the document constitutes a strategic act which is based on the provisions of the Energy Law. It is drawn up for at least 15 years and is subject to at least three-yearly updates. Its purpose is to analyse and assess the forecast changes in demand for heat, electricity, and gaseous fuel, as well as to assess the level of energy security in the municipality and make suggestions for measures to improve it.

The document constitutes a description of all energy systems and energy demand projections. At the same time, energy companies are obliged to prepare their own development plans. If the assumptions are not in line with the companies' development plans, the Mayor of Warsaw prepares heat, electricity, and gas supply plans for individual areas for which the energy companies do not provide supply.

Assumptions to the plan for supply of heat, electricity, and gas fuels for Warsaw constitute a tool for implementing the law when shaping energy management and energy planning in the city. The document is intended to serve energy companies operating in and on behalf of Warsaw, as well as those which may undertake such activities in the field of energy management, to prepare or verify their development plans with respect to, inter alia, satisfaction of the City's present and future demand for energy and gaseous fuels, as well as forecasts concerning the state of security of energy and fuel supply and the volume of energy production in compliance with the provisions of the Energy Law Act, Article 16, item 12, point 2, on an obligatory or optional basis.

The assumptions constitute the basis for planning the development of energy and gas fuel supply systems for the organisational units of Warsaw taking into account, among other things, the requirements of sustainable development, environmental and climate protection as well as equal competition and the need to fulfil international obligations in accordance with the obligation set out in the Energy Law.

In the Assumptions to the plan of supply of heat, electricity, and gaseous fuels for Warsaw, an assessment was made concerning the current state and projected changes in demand as well as its potential to cover demand for heat, electricity and gaseous fuels in the city, based on calculated energy balances and descriptions of the functioning of the electricity, heat, and gas network systems. The balances take into account the energy demand (excluding transport) of all entities operating on the territory of the City of Warsaw and from outside the city which supply Warsaw.

**Study of Conditions and Directions of Spatial Development of Warsaw (replaced by the currently developed so-called General Plan)**

**Territorial scope:** local

**Significance:** the study presents the conditions and directions for spatial development. These are binding for local development plans.

**Description:** The city has drafted a new Study for Warsaw as a vision for the entire city. The study fulfilled three basic functions: it defined the assumptions of the local spatial development policy; it coordinated the spatial assumptions of the city-wide scale at the level of drawing up local spatial development plans; it integrated the individual elements that make up the urban ecosystem. The draft study included many pro-climate solutions, such as the protection of natural resources, the development of a blue-green infrastructure system, the development of sustainable mobility, climate change adaptation and mitigation, the development of technical infrastructure in terms of creating conditions for the introduction, of solutions to support the process of achieving climate neutrality. However, due to changes in the Spatial Planning and Development Act, the municipalities' spatial planning studies will cease to apply from 2026 and their role will be taken over by the municipal development strategy and the municipal general plan. Therefore, Warsaw's authorities have decided to suspend work concerning the new study in favour of preparing a master plan. Most of the materials that have been prepared so far for the study will be used. The currently developed master plan will not set the direction of the city's development. Instead, it will divide the city into planning zones with specific functional profiles for which basic land-use parameters will be defined.

**#Warszawa2030 strategy (in progress)**

**Territorial scope:** local

**Significance:** Strategy for the development of Warsaw up to 2030 sets out the capital's development policy until 2030.

**Description:** The document defines a vision for the city's development, defining it in three dimensions: active citizens, friendly place, open metropolis. It is a general document that defines the city's vision, as well as strategic and operational goals. All documents programming the city's development must refer to the #Warsaw 2030 Development Strategy.

Currently there are works being carried out to update the document, including making climate issues a higher priority by including them in the Strategy as a separate strategic objective or at least as a specific operational objective.

**Environmental Programme for Warsaw for the years 2021-2024 (in the process of being updated)**

**Territorial scope:** local

**Significance:** The Environmental Protection Programme is an executive document for the #Warsaw 2030 Strategy (concerning the operational objective: 3.2. We live in a clean natural environment).

**Description**: Document adopted on 15 April 2021 by a resolution of the Warsaw City Council No XLVII/1470/2021. Works are currently underway concerning a new programme until 2030. The aim

of the measures presented in the document is to improve the quality of life in the city through the sustainable and balanced development of Warsaw as well as the preservation of significant values of the natural environment, improvement of its condition, improvement of spatial order, and development of environmental protection infrastructure. The document emphasises that the natural environment constitutes an important factor influencing the health of residents and the comfort of their lives. It sets short-term goals and actions leading to them, aimed at improving the quality of the natural environment, such as: protecting the surface of the earth and water from pollution and degradation, reducing emissions of pollutants and greenhouse gases into the air (including through disseminating renewable energy sources and energy-efficient solutions), climate protection and adaptation of the city to its changes, increasing the efficiency of waste management (in accordance with the idea of a circular economy), popularizing pro-ecological attitudes among residents, improving the quality and increasing the area of green areas, and activities for biodiversity.

**Municipal Revitalization Programme of Warsaw (under development)**

**Territorial scope:** local (city and district)

**Significance:** The Municipal Revitalisation Programme of Warsaw constitutes a continuation of the Integrated Revitalisation Programme of Warsaw (2015-2022).

**Description:** The document is under development in 2023/2024. An in-depth diagnosis of the revitalisation area in the districts of Praga Południe, Praga Północ, and Targówek was prepared. The work is inclusive and participatory, involving the local community, students, individuals, and institutions interested in the revitalisation process in Warsaw (2 stages of consultation). The objectives of revitalising Warsaw by 2030 are: strong local communities, economic revitalisation of revitalisation sub-areas, high standard of development in revitalisation sub-areas, harmonious and functional space, and a healthy living environment. The last element relates to eliminating threats to the natural environment and building resilience to climate change risks, which requires protecting existing green spaces, increasing their number and quality, developing blue-green infrastructure, enhancing biodiversity, reducing harmful emissions from industrial and traffic sources, as well as counteracting light and noise pollution.

**Climate Change Adaptation Strategy for Warsaw up to 2030 with a perspective for 2050 Municipal Adaptation Plan(in the process of being updated)**

**Territorial scope:** local

**Significance:** it is an urban policy document that sets out the directions of operation, priority areas, and options for adapting to climate change.

**Description:** Climate Change Adaptation Strategy for Warsaw by 2030 with a perspective to 2050. The Municipal Adaptation Plan is a document defining the city's policy for preparing and adapting Warsaw to ongoing climate change, constituting the policy of Warsaw in terms of taking action to prevent and mitigate the negative effects of climate change. The document describes the key threats resulting from climate change and the associated risk areas for Warsaw and its residents, as well as indicating courses of action through which the City will protect itself against the negative effects of climate change-related phenomena. The city is currently preparing for an evaluation

process concerning the document, which will result in making proper adjustments, developing implementation programmes, and creating a monitoring system.

**Warsaw Climate Panel (in progress)**

**Territorial scope:** local

**Significance:** Citizens' panel - a democratic form of involving the residents in the policy-making process of a given city. The provisions of the Warsaw Climate Panel do not have an obligatory (legal) form for the city. However, by decision of the Mayor of Warsaw, the panel's recommendations, which received more than 80% of the panellists' votes, are being implemented by Warsaw and have initiated a number of important pro-climate initiatives and investments in the city.

**Description:** In 2020 - 2021, the city organised the Warsaw Climate Panel with the participation of citizens, community organisations, and experts. The aim of the panel was to enable the citizens of Warsaw to participate in the decision-making process concerning increasing the energy efficiency of Warsaw and the share of renewable energy sources in the city's energy balance. A group of randomly selected 90 residents, representative for the city's social structure in terms of age, gender and education, came up with 49 recommendations, which are being implemented by Warsaw on the basis of the Mayor's commitment.

**Green Vision for Warsaw - Green City and Climate Action Plan**

**Territorial scope:** local

**Significance:** An action plan, in the style of a comprehensive "road map" for a green city and climate. The Green Vision for Warsaw supports implementing climate and greenhouse gas reduction targets contained in other strategic documents of the city. The study establishes new climate targets for Warsaw. It guides the city's development, while pointing to specific measures whose implementation will bring it closer to achieving climate neutrality.

**Description:** The Green Vision of Warsaw is an action plan containing reduction scenarios in the perspective up to 2030 and up to 2050, adopted by Resolution No. LXXX/2648/2023 of the Warsaw City Council of 20 April 2023. The scenarios developed during the work on this document support the implementation of the objectives included in the #Warsaw 2030 Strategy and the Climate Change Adaptation Strategy of Warsaw by 2030 with a perspective to 2050. It combines two methodologies used around the world: the Green City Action Plan, developed by the European Bank for Reconstruction and Development, and the Climate Action Plan, developed by the C40 Cities Climate Leadership Group. Combining these two methodologies allowed producing a document that is comprehensively based on verified data. Creating the Green Vision of Warsaw was preceded by a thorough analysis of the state of the city (based on 122 indicators) in terms of the pressures exerted by various areas of the city's functioning on the environment and climate, the state of the natural environment and the city's responses to environmental and climate risks to date. In accordance with the Green Vision for Warsaw, Warsaw has declared targets for reducing greenhouse gas emissions for the entire city: 40% by 2030 and to achieve climate neutrality no later than 2050. The document is designed so that both the long-term goals and the accompanying

actions are ambitious but also implementable. Its development constitutes the result of Warsaw joining the European Bank for Reconstruction and Development's Green Cities programme in 2020.

## Regional level

**Sustainable Urban Mobility Plan for the Warsaw Metropolis 2030+ (SUMP)**

**Territorial scope: supra-local/regional**

**Significance:** a document having the character of a long-term, coherent transport development plan for the area of the Warsaw metropolis - 70 municipalities and 9 counties with a total area of 6,000 km2 , with more than 3 million residents**.** The Sustainable Urban Mobility Plan is a strategic document to assist in transport and mobility planning.

**Description:** The SUMP for the Warsaw metropolitan area aims to improve the mobility of residents. It will make it possible to make better use of the existing infrastructure in the cities, municipalities, and counties of the metropolis, to plan the expansion of the transport system and maintain its high quality, to coordinate investments. Thanks to the SUMP it will be possible to more efficiently plan a people-friendly space and ensure greater comfort and safety for all traffic participants. The sustainable urban mobility plan is intended to contribute to reducing the negative environmental impacts of transport, such as air pollution, noise and greenhouse gas emissions. A condition for these changes consists in increasing the role of environmentally friendly modes of transport, which include: public, cycling, and walking transport, as well as low-emission transport. Implementing the plan means also greater safety for all road users: drivers, passengers, pedestrians, cyclists, and people with disabilities. Sustainable mobility means both good roads, even pavements taking into account the comfort of all users (including low kerbs) and bicycle paths, as well as improving access to public transport for as many residents as possible. All of these elements are intended to help improve the quality of life for residents and to improve the efficiency and effectiveness of passenger and freight transport.
SUMP includes specific objectives aimed at reducing the negative impact of transport on people and the environment. One of its horizontal objectives (Horizontal Objective II) consists in reducing the environmental and climate impact of transport: "aiming for climate neutrality no later than in 2050" points to the need to reduce emissions from transport in the MW by nearly half already in 2030 (compared to 2019 levels) and a decrease of at least two-thirds thereafter compared to 2030 values.

**Warsaw Metropolitan Area Development Strategy up to 2030**

**Territorial scope:** supra-local/regional

**Significance:** a document of a strategic nature that aims at a functional integration of the metropolitan area, i.e. the development not only of internal functions but also of external metropolitan functions that are located in various parts of the area.

**Description:** The strategy covers Warsaw and 71 municipalities that make up the Warsaw Metropolitan Area (WMA). The main objectives of the Strategy are: to strengthen the rank of the WMA on a European scale and to deepen cooperation between WMA members, to ensure full external and internal mobility of the residents of the WMA through integration of the public transport

network, to create a modern metropolitan space, to provide the residents with wide access to cultural and natural resources, to strengthen the WMA as a pole of economic growth.

**Integrated Territorial Investments Strategy for the Warsaw Functional Area 2014-2020+**

**Territorial scope:** supra-local/regional

**Significance:** this is a document which indicates undertakings planned for implementation within the framework of EU funds allocated in the Regional Operational Programme for the Mazowieckie Voivodeship. The Integrated Territorial Investment Strategy for the Warsaw Functional Area 2014-2020+ also constitutes an implementation document for the Development Strategy for the Warsaw Metropolitan Area up to 2030.

**Description:** Integrated Territorial Investments (ZITs) constitute an instrument that contributes to implementing the development strategies of cities and their functional areas, through the implementation of integrated projects co-financed by EU funds. Integrated Territorial Investments constitute a manifestation of the territorial dimension of cohesion policy. They enable implementing joint projects combining actions funded by the European Regional Development Fund and the European Social Fund. This instrument allows for going beyond the rigid administrative boundaries of local government units, thus providing opportunities for greater impact of EU projects. It is designed to allow developing a mechanism for territorial coordination and mutual cooperation in the field of programming and implementing actions and activities to integrate the capital with municipalities with strong functional links to it. Objective 3. The document: "Improving the quality of space" discusses, among other things, the striving for a low-carbon environmentally friendly economy and efficient use of existing energy resources, as well as sustainable transport. Energy efficiency measures are provided here mainly in the public transport, heating and building sectors.

**Development Strategy of the Mazowieckie Voivodeship 2030+. Innovative Masovia**

**Territorial scope:** regional

**Significance:** a document which sets out a vision for developing the voivodeship, defines the main objective to which strategic objectives are subordinated, consistent with the long-term priorities for developing the voivodeship

**Description:** The strategy constitutes an integrated document, i.e. it defines the objectives and directions of the socio-economic development of the voivodeship in the spatial (territorial) dimension, which was strengthened by including a model of the functional and spatial structure of the voivodeship in the strategy, closely linked to the Spatial Development Plan for the Mazowieckie Voivodeship.

The Strategy identifies the directions of action and activities broken down into five thematic areas. The territorial dimension of the intervention was also defined, including the areas of strategic intervention of the voivodeship to which support will be directed, aimed at meeting the specific development needs of these areas.

**Environmental Impact Assessment for the Development Strategy of the Mazowieckie Voivodeship 2030+ Innovative Mazovia**

**Territorial scope:** regional

**Significance:** a document aiming at, inter alia, identifying potential threats to the environment and people associated with the implementation of the provisions of the draft Development Strategy of the Mazowieckie Voivodeship 2030+, and ways to reduce potential significant environmental impacts associated with the implementation of the provisions of the document.

**Description:** The main elements of the Assessment include: an analysis of the state and potential changes of the natural environment, the state of the environment in the areas covered by the anticipated significant impact, the existing environmental protection problems significant from the point of view of implementing the draft document, the environmental protection objectives set at international, Community and national level, significant from the point of view of the draft document, the anticipated significant environmental impacts, the solutions aimed at preventing, limiting or compensating for negative environmental impacts which may arise as a result of the implementation of the Strategy's findings.

## National level

**The Act of 27 April 2001 - Environmental Protection Law**

**Territorial scope:** national

**Significance:** the Act defines the principles for environmental protection and the conditions for using its resources, taking into account the requirements of sustainable development.

**Description**: the Environmental Protection Act deals with the rules on the protection of environmental resources and the conditions of use of the environment, including the introduction of substances or energy into the environment. It determines the responsibilities of the administrative bodies in this respect as well as the liability of the various actors for environmental damage with sanctions. It imposes administrative obligations on those who use the environment or whose activities significantly affect nature.

**Poland's Energy Policy up to 2040**

**Territorial scope:** national

**Significance:** Poland's Energy Policy up to 2040 sets the framework for the country's energy transition and includes strategic decisions concerning the choice of technologies to support the construction of a low-carbon energy system. It is closely linked to the EU's climate policy, which determines long-term goals such as climate neutrality by 2050 as well as the targets for 2020 and 2030. The main objective is further specified by eight policy directions divided into areas and further detailed by twelve strategic projects. They constitute an extension of the list of projects of the Strategy for Responsible Development from the area "Energy"

**Description:** The objective of Poland's Energy Policy up to 2040 is energy security - while ensuring the competitiveness of the economy, energy efficiency and reducing the environmental impact of the energy sector - taking into account the optimal use of own energy resources. The document describes key investment decisions to exploit national potential in the areas of energy, raw materials, technology, and human resources. The plan is directed at creating conditions favourable

for developing the economy through the energy sector, while maintaining the principles of a fair transition.

**Development plan for meeting the current and future electricity demand for 2023-2032**

**Territorial scope:** national

**Significance:** The plan determines the forecasts concerning the development of power grids in the country and forecasts concerning changes in the diversification of electricity generation.

**Description:** The transmission system development plan for 2023-2032 prepared by Polskie Sieci Energetyczne constitutes the result of many years of technical and economic analyses, taking probabilistic methods into account. The plan analyses various scenarios for developing the electricity system to identify investments that improve the reliability of energy supply.

The plan includes: meeting the targets concerning the share of RES energy in final energy consumption, constructing offshore wind farms in the Baltic Sea, building nuclear capacity, connecting new generation units, improving power supply conditions, including minimising grid congestion across the system.

**National Energy and Climate Plan for the years 2021-2030 (in the process of being updated)**

**Territorial scope:** national

**Significance:** a key document for both the Polish energy sector and other sectors of the economy. It presents national objectives and targets as well as policies and actions relating to five dimensions - reducing emissions, energy efficiency, energy security, the internal energy market and research, innovation and competitiveness. Currently in the process of being updated.

**Description:** It is a strategic document determining the objectives and policies related to the energy union. The plan was created after taking into account expert opinions, public consultations, and recommendations from the European Commission. It focuses on 5 dimensions: 1. Reducing emissions, 2. Energy efficiency, 3. Energy security, 4. Internal energy market, 5. Research, innovation and competitiveness. The plan describes the possibilities for energy transition, taking into account EU plans, targets and objectives. The National Energy and Climate Plan presents key tools and measures concerning the energy sector, while responding to existing EU legislation.

**Long-term building renovation strategy up to 2050**

**Territorial scope:** national

**Significance:** A long-term building renovation strategy that identifies the actions that are needed to ensure that private and public buildings in Poland are highly energy efficient and low-emission by 2050.

**Description:** The document defines the actions necessary to achieve high energy efficiency and low carbon buildings in Poland in the 2050 perspective. The renovation of the building resources constitutes one of Poland's biggest infrastructure challenges up to 2050. As in other EU Member States, Polish buildings should be modernised in the long term in a manner consistent with the transition towards a climate-neutral economy. At the same time, national public policy must respond

to the urgent need to replace the most emitting sources of heat, in order to improve air quality while ensuring that the value of buildings is improved**.** This strategy aims to make buildings in Poland more energy efficient and environmentally friendly. It proposes a renovation scenario and guidance on how to support the modernisation of buildings. The renovation of building constitutes a significant challenge until 2050 and is in line with the European Union's climate neutrality targets. At the same time, the strategy takes into account the urgent need to replace the most emitting heat sources in order to improve air quality and maintain the economic efficiency of the modernisation. A key objective of the modernisation consists in reducing energy consumption and $CO_2$ emissions, while at the same time taking care of the health and safety of the people living in the buildings. The strategy carries out a comprehensive diagnosis of the building renovation challenge and proposes a scenario for the modernisation of buildings in Poland by 2050. The document also includes public policy guidelines and indicators to monitor the implementation of the strategy.

**A strategy for heating up to 2030 with a perspective up to 2040** (under development)

**Territorial scope:** national

**Significance:** The strategy will describe the capabilities of the domestic heating sector and the projected modernisation pathways for the sector. The document will forecast heat demand by sector and present possible innovations and solutions for modernisation. It will also constitute a significant addition to the local heat supply plans for the city.

**Description:** The Ministry of Climate and Environment assumes that the Strategy for the Heat Sector up to 2030 with a perspective up to 2040 will be ready by the end of 2024**.** The Strategy will constitute a key planning document to bring the energy sector in line with both national and EU requirements, particularly in the context of the New Green Deal. The heating strategy will take into account the need to guarantee a secure and economical heat supply to consumers and emphasises the key role of local government in organising this supply. This document takes into account the current state of the sector, an analysis of regulations and market conditions as a starting point for necessary changes. The document will indicate optimal directions and methods for the transformation of the heating sector in Poland in order to meet strategic objectives and ensure security of energy supply at acceptable prices.

**Strategic adaptation plan for sectors and areas sensitive to climate change by 2020 with a perspective up to 2030, the so-called SPA2020 (in the process of updating)**

**Territorial scope:** national

**Significance:** (SPA2020) is a document that determines specific actions that Poland should take to adapt to climate change.

**Description:** The document describes the different sectors and areas that are most vulnerable to the effects of climate change, such as water management, agriculture, forestry, biodiversity, health, energy, construction and spatial development, urbanised areas, transport, mountain areas, and coastal zones.

The plan includes specific objectives and actions to be implemented until 2020, with a perspective up to 2030. These measures include both investments in infrastructure as well as changes in regulations.

**Strategy for Responsible Development by 2020 (with a perspective for 2030).**

**Territorial scope:** national

**Significance: it is a document** of a strategic nature, which defines the basic conditions, objectives, and directions of the country's development in the social, economic, regional, and spatial dimensions up to 2030.

**Description:** the Strategy for Responsible Development presents a new development model - responsible development as well as socially and territorially sustainable development. The strategy includes recommendations for public policies and provides the basis for changes in the development management system and for updating or drawing up new strategic documents. The main objective of the Strategy for Responsible Development is "To create conditions for an increase in the income of the Polish population while increasing cohesion in the social, economic, environmental, and territorial dimensions."

**State Environmental Policy 2030 - a development strategy in the field of environment and water management**

**Territorial scope:** national

**Significance**: it is the most important environmental policy document**.** The document clarifies the provisions of the Strategy for Responsible Development and presents practical solutions for the specific directions of intervention.

**Description:** The State Environmental Policy determines three specific objectives, which are further supported by two horizontal objectives:

Horizontal objectives: Environment and education - to develop the environmental competences (knowledge, skills, and attitudes) of the public, Environment and administration - to improve the efficiency of the functioning of environmental protection instruments.
Specific objectives: I. Environment and health, II. Environment and Economy, III: Environment and Climate. The strategy supports the implementation of Poland's objectives and commitments at an international level, including at the EU and UN level, particularly in the context of the EU's 2030 climate and energy policy objectives and the sustainable development goals included in Agenda 2030.

**Act of 20 February 2015 on renewable energy sources**

**Territorial scope:** national

**Significance:** the law that regulates the use of renewable energy sources.

**Description:** the Act defines renewable energy sources and determines the principles and conditions for operating in terms of energy production from renewable energy sources. It mandates developing a National Renewable Energy Action Plan that takes into account greenhouse gas reduction and climate protection targets. It describes support mechanisms for renewable energy producers to reduce greenhouse gas emissions. It includes the principles determining tariffs for electricity produced by renewable energy installations that can contribute to emission reductions and climate protection. It mandates the necessity for preparing reports concerning the production of

energy from renewable sources, which may include information on the impact on reducing greenhouse gas emissions.

**Act of 17 July 2009 on the system for managing emissions of greenhouse gases and other substances**

**Territorial scope:** national

**Significance:** the purpose of the Act is to establish a system for managing emissions of greenhouse gases and other substances

**Description:** the Act determines the principles for managing greenhouse gas and other substance emissions in Poland and for the functioning of institutions. It defines greenhouse gases, defines obligations related to the monitoring and reporting of greenhouse gas emissions by entities operating installations, establishes and defines the tasks of the Air Protection and Climate Policy Department (KOBiZE), which performs tasks related to the monitoring, reporting and forecasting of pollutant emissions in Poland and tasks related to the administration of the EU greenhouse gas emission trading scheme

**Act of 7 July 1994. - Building Law.**

**Territorial scope:** national

**Meaning:** it normalizes activities involving matters of design, construction, maintenance and demolition of buildings and sets out the rules for state administrative bodies in these areas.

**Description:** it determines the basic requirements for construction works, including ensuring energy efficiency and protection of the environment, which includes climate-related aspects, it includes the principles design principles that must take into account energy efficiency and environmental protection requirements as well as the requirements for building design, which must include technical and material solutions to ensure that energy efficiency and environmental protection requirements are met. It describes the obligations of owners and managers of buildings to maintain those buildings in a way that ensures that environmental requirements are met. It provides sanctions for violating the provisions concerning energy efficiency and environmental requirements in the construction process.

**Act of 27 March 2003 on spatial planning and development**

**Territorial scope:** national

**Significance:** the Act sets out the principles for formulating the spatial policy by local government units and government administration bodies, the scope and methods of proceeding in matters concerning allocating land for specific purposes as well as determining the principles of its development and construction - taking spatial order and sustainable development as the basis for these activities.

**Description:** The Act covers the formation of spatial policy, including the principles of sustainable development and environmental protection, as well as the requirements and principles for creating planning and spatial development documents by local government bodies. It regulates cooperation

between public administration bodies in the field of spatial planning, taking into account environmental and climate protection requirements.

**Act of 10 April 1997 - Energy Law**

**Territorial scope:** national

**Meaning:** the Act regulates all matters relating to state energy policy. Its objectives include sustainable energy development as well as the rational use of fuels and energy.

**Description**: The Act determines: the principles for supplying fuels and energy; the principles of state energy policy; the powers and rules of operation of the President of the Energy Regulatory Authority**;** the provisions concerning energy licenses and tariffs; the provisions concerning energy equipment, installations, networks, and their operation. It sets out the obligations of energy companies within the scope of applying the principles of sustainable development and promoting energy efficiency. it describes the rules governing the activities of electricity system operators, including obligations related to the integration of renewable energy sources and the reduction of greenhouse gas emissions, as well as the sanctions for violating the Act, including for actions that are not in line with environmental protection and energy efficiency principles.

**Act of 20 May 2016 on energy efficiency**

**Territorial scope:** national

**Significance:** the Act implements the Energy Efficiency Directive (EED/2012/27/EU) provides for comprehensive measures to increase energy efficiency and reduce energy consumption.

**Description:** the aim of the Act is to improve energy efficiency and reduce the negative impact on the environment, including the climate. It provides a definition of energy efficiency, which includes the rational use of energy and the reduction of greenhouse gas emissions. It imposes an obligation on public sector entities and energy companies to achieve energy savings, and regulates the system of white certificates to promote projects that improve energy efficiency and reduce greenhouse gas emissions. The Act also introduces an obligation for large entrepreneurs to carry out energy audits to identify the possibility for energy efficiency and emission reductions, and sets out the principles for cooperation between public administrations in promoting energy efficiency and climate protection measures.

**Act of 11 January 2018 on electromobility and alternative fuels**

**Territorial scope:** national

**Significance:** the Act determines the principles for the development and operation of infrastructure for the use of alternative fuels in transport.

**Description**: The aim of the Act is, among other things, to promote electromobility and the use of alternative fuels. It includes definitions of the terms "electromobility" and "alternative fuels", as well as the objectives of the electromobility policy. it regulates the principles of planning and implementing electromobility activities as well as the use of alternative fuels, financial support mechanisms for entrepreneurs and entities implementing projects related to electromobility and alternative fuels, information obligations for alternative fuels; conditions for the functioning of clean

transport zones; defines the national policy framework developing the infrastructure of alternative fuels and how it is implemented.

**The Act of 14 December 2012 on waste**

**Territorial scope:** national

**Significance:** the Act defines the objectives and principles of waste management.

**Description**: the Act sets out the measures to protect the environment, life, and human health by preventing and reducing the generation and management of waste and by reducing the overall impact of using resources and improving the efficiency of such use, with the aim of moving towards a circular economy. An obligation is placed on entities responsible for waste management to act in a way that minimises the negative impact on the climate.

## European Union level

**The European Green Deal**

**Territorial scope:** EU

**Significance:** a strategy - a set of policy initiatives aimed at putting the EU on the path to environmental transition and achieving climate neutrality by 2050.

**Description:** The European Green Deal aims to transform the EU into a fair and prosperous society with a modern and competitive economy, based on a comprehensive action plan to reduce greenhouse gas emissions and combat climate change. Key elements of the document consist in the promotion of renewable energy sources, the improvement of energy efficiency, the development of sustainable transport, international cooperation and investment in innovation, as well as the reduction of negative environmental impacts and the improvement of citizens' quality of life. It is expected to result in: clean, affordable energy, the transformation of industry along the lines of a circular economy, efficient, green building (saving energy and resources), the preservation and protection of biodiversity, the building of a healthy, fair, and environmentally friendly food system, sustainable and intelligent mobility.

**Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on establishing a framework to facilitate sustainable investment.**

**Territorial scope:** EU

**Significance:** This document imposes information and reporting obligations on financial institutions and companies, seeking to increase transparency and accountability in the context of environmental and social issues. The regulation also determines the limits of $CO_2$ emissions related to generating energy, which significantly affects the mission objectives. These principles force the modernisation of carbon-intensive CHP plants, leading to a reduction in $CO_2$ emissions during energy production.

**Description:** Regulation (EU) 2020/852 of the European Parliament and of the Council was adopted to establish a single European policy for environmentally sustainable investments. Its main objective is to create a coherent system of environmental and social classifications that facilitates

the identification of investments in line with sustainable development goals. It determines the categories of sustainable investment, covering areas such as climate change, environmental protection, energy efficiency, circular economy, sustainable use of natural resources, biodiversity conservation, health and education. It also introduces a disclosure obligation related to sustainable financial activities for investment firms, financial advisers and listed companies. The regulation is crucial for accelerating the transition towards a more sustainable economy and is part of the European Union's broader plan for funding sustainable development. It constitutes an instrument to support the long-term goals of climate change, environmental protection and social responsibility.

**Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (RED II Renewable Energy Directive).**

**Territorial scope:** EU

**Significance:** The Directive at European Union level sets a binding target of 32% share of energy from renewable sources in gross final consumption by 2030. This document directly affects the heating sector, forcing an annual increase in the share of heat from RES and waste heat supplied to consumers by at least 1.1 percentage points (y/y) by 2030, or 1.3 percentage points including waste heat.

**Description:** The Directive constitutes a crucial piece of European Union legislation aimed at promoting and intensifying the use of energy from renewable sources. This document sets out specific targets, commitments and support mechanisms to accelerate the transformation of energy sectors. The main elements of the directive include establishing an overall target that by 2030 at least 32% of the European Union's total energy consumption should come from renewable sources. Moreover, the directive imposes specific targets for the share of renewable energy in the transport and heating sectors, striving for sustainable growth and reduced greenhouse gas emissions.

**Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing a framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 (European Climate Law)**

**Territorial scope:** EU

**Significance:** The regulation constitutes one of the instruments aimed at meeting the objectives of the European Green Deal.

**Description:** The European Climate Law includes a legal goal set out in the European Green Deal to make Europe's economy and society climate-neutral by 2050. The law also sets an interim goal of reducing net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels.

**Regulation (EU) 2023/955 of the European Parliament and of the Council of 10 May 2023 establishing a Social Climate Fund and amending Regulation (EU) 2021/1060**

**Territorial scope:** EU

**Significance:** it establishes a fund with the aim of contributing to a socially just transition towards climate neutrality by addressing the social impacts of including greenhouse gas emissions from the buildings and road transport sectors.

**Description:** the Regulation establishes a Social Climate Fund for the period from 2026 to 2032.

The Fund provides financial support to Member States for measures and investments included in their socio-climate plans.

Measures and investments supported by the Fund must benefit vulnerable households, micro-enterprises and transport users particularly affected by the inclusion of greenhouse gas emissions from the buildings sector and the road transport sector in the scope of Directive 2003/87/EC, in particular energy-poor households or transport-poor households.

**Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency.**

**Territorial scope:** EU

**Significance:** the Directive determines the tasks for the Member States of the Union with regard to the energy efficiency of buildings on a multiannual basis.

**Description:** The directive aims to improve the energy performance of buildings in the EU, taking into account climatic and local conditions.

It sets out minimum requirements and a common framework for calculating energy performance.

Following a review of implementing Directive 2010/31/EU, it was amended in 2018 by Directive (EU) 2018/844. The main objective was to accelerate the cost-effective renovation of existing buildings and promote smart building technology. As part of the "Clean Energy for All Europeans" package, the amending directive complements the energy efficiency legislation.

**Directive (EU) 2024/1275 of the European Parliament and of the Council of 24 April 2024 on the energy performance of buildings (recast).**

**Territorial scope:** EU

**Significance:** the Directive promotes improving the energy performance of buildings and reducing greenhouse gas emissions from buildings in the Union with the aim of achieving a emission-free building resources by 2050.

**Description:** Directive (EU) 2024/1275 aims to increase the energy efficiency of buildings in the EU, reduce greenhouse gas emissions and promote sustainable construction. It includes new and existing buildings, introduces minimum energy efficiency requirements, promotes building renovations and modernisation, as well as the integration of renewable energy sources. Member States are obliged to monitor, report, and enforce these requirements.

**Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on governance of the energy union and climate action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives**

**94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council**

**Territorial scope:** EU

**Significance:** the regulation sets out the necessary legal basis for sound, comprehensive, cost-effective, transparent, and predictable governance of the energy union and climate action.

**Description:** this regulation establishes a management mechanism to achieve the 2030 targets and objectives of the energy union and in the long term, in line with the 2015 Paris Agreement on climate change.

Scope: The energy union should encompass five dimensions: energy security, the internal energy market, energy efficiency, decarbonisation, as well as research, innovation, and competitiveness

The aim of a stable energy union pursuing an ambitious climate policy is to provide EU consumers - including households and businesses - with a secure, sustainable, competitive, and affordable energy supply and to stimulate research and innovation by attracting investment.

**Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU with regard to corporate sustainability reporting.**

**Territorial scope:** EU

**Significance:** it imposes an obligation on companies to report annually according to common European sustainability reporting standards.

**Description:** Under the Regulation, all large entities as well as small and medium-sized listed companies will provide information on environmental, social and human rights issues and corporate governance in their management report.

The provisions of the Regulation provide for a three-stage timetable concerning he application of the new obligations by individuals. Initially, the information will be presented (for the financial year 2024) by the largest entities that already report so-called non-financial information under the Accounting Act. These are large public interest entities with more than 500 employees. A year later, the first reports will be presented by the other major entities. Small and medium-sized listed companies will report for the first time for the 2026 financial year.

## Assessment of plans, policies, and strategies

Issues concerning sustainability and climate policy are complex, systemic, interdisciplinary, and affect a great number of areas of the society's functioning. Therefore, they are regulated by a great number of separate pieces of legislation, created for different areas of regulation (spatial policy, buildings, energy, transport, water relations, finance, environmental policy, etc.) as well as strategy and policy documents. These acts and documents are not always consistent with each other - during development they often focus on the specifics of a dedicated thematic area. These inconsistencies are evident at local as well as the regional, national, and European level.

Warsaw is currently in the process of reviewing and aligning policies, regulations and documents affecting climate policy and sustainable development policy. The first step towards this consisted in

developing a roadmap describing how the manner in which the city would achieve climate neutrality and sustainability measures - the Green Vision for Warsaw (GCCAP). The policies and documents of a local nature listed in this section of the Action Plan are or will be amended in terms of consistency and compatibility with the Green Vision for Warsaw and the Climate City Contract.

There is also a lack of consistency in terms of regulations and policies at the national level, setting and supporting the achievement of reduction targets. This is evidenced by European Commission Recommendation 2024/608 of 18 December 2023. on the coherence of Poland's measures with the EU's climate neutrality target and with ensuring progress in adapting to climate change, which recommends, inter alia, establishing an appropriate legal framework for climate change adaptation policies and related actions, which recommends, inter alia: intensifying mitigation efforts by making measurable progress in implementing existing and planned strategies, as well as considering additional urgent measures to align assumed and planned greenhouse gas emission reductions with the climate neutrality target.

Local operation in cities needs to be supported by regulations at the national and regional level, which enable more effective protection of green areas and water resources from urbanisation pressures (regulations in spatial policy, building law, environmental law), implementation of building efficiency standards (building law and other building regulations), facilitate investment in renewable energy sources (RES Act and strategy documents), provide incentives for rapid energy decarbonisation (energy law and other energy regulations), and provide incentives for rapid energy decarbonisation (energy law and other energy regulations). support the development of low-emission transport and create the frameworks for a circular economy.

National and European regulations and policies are highly fragmented and scattered. They require a more coherent form and simplification, and perhaps codification, understood as a process of bringing together a large set of laws, strategies and policies into a single, structured set that will assume:

- greater coordination of mitigation and adaptation activities,
- holistic and systemic approach to mitigation, adaptation and GOZ in place of fragmented, non-seeing actions, policies,
- integration of activities at various levels (EU, supranational, national, regional, local) concerning planning, implementing, monitoring, and evaluating actions,
- integration and coordination of policies and actions between sectors (energy, buildings, BZI, transport) - an integrated approach.

Greater integration of legal frameworks and policies will make it easier to carry out integrated, systemic activities, which will make more efficient use of resources and increase their effectiveness through synergies.

A detailed analysis of individual policies and legislation as well as their individual impacts on the actions described in the Climate City Contract requires further work, which will be addressed in subsequent iterations of the Action Plan.

## 2.3 Module A-3 Systemic barriers and opportunities for achieving climate neutrality in 2030.

The most important identified systems in the city from the point of view of climate neutrality measures:

| System | Impact of the system on the goal of climate neutrality | Assessment of the system |
|---|---|---|
| technological/infrastructure | - production, distribution, and storage of heat and electricity,<br>- transport systems,<br>- waste management,<br>- blue-green infrastructure,<br>- spatial planning,<br>- construction. | **Most important advantages:**<br>- an extensive heating network covering 80% of the city,<br>- a developed public transport system,<br>- a developed network of cycling routes,<br>- a great potential for blue-green infrastructure development (significant proportion of valuable green areas in the urban space).<br>**Key limitations:**<br>- network heat with a large carbon footprint (coal and gas based)<br>- dependence on the national electricity grid (producers and distributors independent of the local authority) based on fossil fuels,<br>- outdated electricity infrastructure that does not belong to the city,<br>- lack of direct impact on the energy efficiency of buildings that do not belong to the city,<br>- lack of efficient energy storage solutions,<br>- lack of charging infrastructure for electric vehicles and hydrogen refuelling. |
| institutional/regulatory | - decarbonisation and adaptation strategies and policies, and sector-specific strategies and policies relevant to climate neutrality and adaptation, | **Most important advantages:**<br>- the city's ownership of strategic documents concerning decarbonisation and adaptation measures,<br>- cyclical greenhouse gas inventories,<br>**Key limitations:** |

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| | - institutions responsible for implementing, managing, regulation and research, as well as monitoring greenhouse gas reduction processes. | - lack of a coherent climate governance system in the city (work in progress),<br>- the lack of a coherent climate policy at national level to support decarbonisation targets,<br>- the lack of regulations at a national level giving local authorities greater impact over the protection of blue-green infrastructure from urbanisation pressures and the energy efficiency of private buildings and the development of their surroundings. |
| organisational | - coordination of measures concerning the reduction of greenhouse gas emissions in various sectors and areas,<br>- cooperation with urban stakeholders,<br>- speed and adequacy of decision-making processes related to planning, implementing, and monitoring decarbonisation measures,<br>- effectiveness of decarbonisation measures. | **Most important advantages:**<br>- a dedicated unit (Air Protection and Climate Policy Department) in the City of Warsaw coordinating and initiating climate-related processes and projects,<br>- an interdisciplinary body (Climate Team) to coordinate climate policy activities at a city-wide/strategic level,<br>- experience and best practice in working with urban stakeholders,<br>- cooperation with districts and other municipal entities<br>**Key limitations:**<br>- a silos character of the functioning of the City of Warsaw and the lack of sustainable, systemic solutions enabling interdisciplinary cooperation,<br>- lack of systemic solutions integrating climate risks into the decision-making process at the city management level as well as in investment planning and implementation. |
| financial | - measures to finance investments to support the achievement of reduction targets,<br>- financial support programmes for residents and businesses, | **Most important advantages:**<br>- experience in implementing major investment projects (especially in the area of public transport),<br>- functioning support systems for residents in the form of municipal subsidies for replacing high-carbon heat sources and for systems concerning renewable energy sources, retention,<br>- a financial support system in operation concerning renewable energy systems |

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| | | for municipal entities (Municipal Photovoltaic Development Programme)<br>**Key limitations:**<br>- lack of sufficient funds in the city budget for large-scale investments and support schemes for residents in cost-intensive areas (public transport, thermal modernisation of buildings, transport infrastructure)<br>- little experience in using public-private partnerships and other forms of cooperation with business to finance public investment,<br>- limited availability of external investment funds and support programmes (too short timeframes for settlement of investments with funds from the National Reconstruction Plan and restrictions on the use of credit by local authorities due to statutory debt thresholds)<br>- limited resources preventing the use of dispersed and very specific external funding programmes with different rules (national funds, European funds) |
| political | - policy decisions, supporting decarbonisation efforts by removing barriers and mobilising resources,<br>- the political base supporting climate neutrality measures (at national, regional and local level) in support of decarbonisation efforts and its sustainability, | **Most important advantages:**<br>- extensive cooperation of national and local authorities with EU and international institutions in the field of climate policy.<br>**Key limitations:**<br>- the lack of a consensus among key political forces concerning the climate crisis and the action needed,<br>- inconsistency in terms of political decisions concerning climate neutrality measures - changing decisions under the influence of interest groups,<br>- underestimating the seriousness of the situation by a large proportion of politicians, due to a lack of knowledge or worldview. |
| social | - self-organisation and community involvement in the city, | **Most important advantages:**<br>- an active society, a large number of organisations, social movements, and associations in the city, including those |

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| | - the activity of citizens and local communities,<br>- cooperation between the city and the civil society as well as local communities in favour of pro-climate change,<br>- the prevailing values and attitudes and the level of climate and environmental awareness of the population influencing the level of public acceptance of pro-climate measures. | working on the environment and climate,<br>- the city's extensive experience and systemic tools concerning public participation and resident involvement (public consultations, workshops, participatory budgeting),<br>- systemic cooperation between the city and social organisations (delegation of public tasks, consultations, industry social dialogue committees, partnerships),<br>- a relatively high level of public awareness of the climate and environmental crisis.<br>**Key limitations:**<br>- a low level of specific knowledge concerning the causes of climate change and the action needed,<br>- a reluctance to make pro-climate changes (particularly in the area of transport) of a large part of the population,<br>- passivity and indifference of a significant proportion of the population in the face of climate risks. |
| behavioural | - behavioural patterns and habits regarding areas affecting emissions. | **Key limitations:**<br>- transport habits: the attachment of a large proportion of residents to individual car transport,<br>- inefficient consumption habits (waste of energy, food, water), |

**Main barriers and gaps identified in the city.**

1. **High costs and unknown scale of energy efficiency needs for buildings.** Three quarters of the city's emissions form from the production of energy (electricity and heat) and its consumption by buildings. According to the results of the latest GHG inventory (for 2022), Warsaw's dominant sector, in terms of emissions, consists in stationary energy (electricity and heat production and consumption by buildings), which accounts for 73% of the city's total emissions. The number of municipal buildings in need of deep thermal modernisation is approx. 1200 public utility buildings (including 237 listed historical buildings) and 1197 single-family and multi-family residential buildings (including 607 listed historical buildings). The cost of such thermal modernisation has been estimated in the Green Vision for Warsaw at more than PLN 5 billion (an amount estimated before inflation due to the war in Ukraine and should now be increased by approx. 20%). In addition, there are buildings that do not belong to the city. According to the Land and Building

Register, there are more than 180,000 buildings of various uses in Warsaw. The condition and energy performance of most of them is unknown. In Poland, the Integrated Low Emission Reduction System (ZONE), of which the Central Emission Inventory for Buildings (CEEB) is a part, has recently been implemented, but it does not yet have enough data to estimate the scale of thermal modernisation needs for all buildings in the city. The biggest challenges to climate transformation in our assessment are: buildings with unregulated ownership, buildings in a poor state of repair, buildings listed on the historic register or under conservation protection. In the two districts covered by the Climate City Contract, the number of total buildings is similar, with a very large difference in the number of urban buildings: Praga-Południe approx. 12,000 buildings (of which 1,392 are municipal), Ursynów approx. 11,000 (including 30 municipal). Thermal modernisation of buildings is crucial for achieving the climate neutrality of Warsaw. All available analyses say that it is impossible to produce as much heat energy from renewable sources as is currently consumed by buildings in Warsaw.

Actions to be taken:

a. completing building data in the Integrated Low Emission Reduction System (ZONE),
b. carrying out a thermal imaging survey of buildings in the mission districts,
c. launching (at national and EU level) systemic programmes of financial support for the deep thermal modernisation of buildings and an advisory system to make the programmes easier to use and more accessible.

2. **Limitations in developing blue-green infrastructure (BZI)**. The city has a high potential for developing the BZI, but is increasingly facing challenges such as: a lack of sites for new tree planting (mainly through conflicts with underground infrastructure), a complicated land ownership structure (open areas, valuable in terms of nature, are often outside the city's ownership and not protected against development), urbanisation pressure from private investors for more land, increasingly difficult habitat conditions for plants in the city (heat waves, droughts, frosts, emergence of new pests, diseases and invasive species), multiple entities responsible for maintaining the city's green spaces.

   **Actions to be taken:**

   a. legislative changes at the national level enabling local authorities to protect valuable areas more effectively against urbanisation pressures and introducing quality standards for investors concerning the development of the surroundings of linear and cubic investments (e.g. concerning the quality of biologically active surface or the management of rainwater on a plot),
   b. implementing the Warsaw Green Building Standard currently being developed for new and modernised municipal buildings, an important element of which is the requirement to apply the Warsaw Green Management Standards,
   c. introducing uniform standards for developing and maintaining green spaces for all those responsible for maintaining urban green spaces,
   d. selecting plant species with increased resistance to heat, drought, and other hazards.

3. **Lack of a developed network of local and district centres**. A large proportion of housing estates do not have sufficiently developed service centres, forcing residents of these areas to

meet many of their needs in the centre of the capital. This results in more pressure on the public transport network and increased traffic within the city.

**Actions to be taken:**

a. developing a feasibility study and a development plan for the mission districts in terms of the 15-minute city concept (the concept assumes that most daily needs can be met within a 15-minute walking distance).

4. **Dependence on the National Grid (KSE) and the national energy mix.** Warsaw has very limited impact on the sources of power generation, which are regulated at national level. There are two energy companies operating within the city, which supply 80% of the city's heating needs, are independent of the city, and are not obliged to consult their development plans with the local authority. During the winter period, the city's demand is covered by 63% from CHP sources at Siekierki CHP Plant and Żerań CHP Plant. During the summer, the Warsaw electricity system requires support from the KSE at a level of approximately 80%.
The heating sector in Warsaw is based on heat production from fossil fuels, coal, and natural gas, with a residual use of biomass. Whereas, the current national energy mix is based on fossil fuels. The main fuel is coal. For example, in 2022, 66.2% of the country's heat production came from coal and almost 16% from other fossil fuels: natural gas and fuel oil (Energy Regulatory Office - Report: Thermal power industry in numbers - 2022),

   **Actions to be taken:**

   a. decarbonisation and modernisation of the national energy system,

   b. creating a local strategic partnership between the city and the main energy producers and suppliers in the city in order to agree on joint decarbonisation measures, including: increasing energy production from non-fossil sources (e.g. biogas), reducing energy losses on transmission networks and distribution lines, using waste energy (from industrial processes, refrigeration processes, undergrounds, server rooms), storing energy, increasing the offer of certified green energy sales, seeking new sources of energy supply.

5. **Limited direct impact on the city's greenhouse gas emissions.** The GHG inventory in Warsaw, for the years 2018, 2020, 2022, shows that the share of urban units in the emissions of the entire of Warsaw oscillated at approximately 7.4% (concerns Scope 1 and 2 emissions). This means that entities over which the city has no direct influence are responsible for the majority of emissions.

   a. involving the widest possible range of urban stakeholders in climate neutrality efforts,

   b. launching (at national and EU level), a broad, attractive programme of incentives (subsidies, discounts) for residents, businesses, and other municipal entities encouraging action to reduce greenhouse gases in various sectors (energy efficiency of buildings, conversion to renewable energy sources, electromobility, etc.).

6. **Difficulties in using data.** Sources of data (environmental, energy, and other) are highly dispersed and are often held by external entities that are not obliged to provide them to the Office of the City of Warsaw. There is no integrated database to collect and process it quickly. This makes it difficult to carry out monitoring and evaluation processes concerning sustainability and emission reduction measures.

   **Actions to be taken:**

a. completing building data in the Integrated Low Emission Reduction System (ZONE),

b. carrying out a thermal imaging survey of buildings in the mission districts,

c. launching (at national and EU level) systemic programmes of financial support for the deep thermal modernisation of buildings and an advisory system to make the programmes easier to use and more accessible.

7. **Problems with using rainwater.** Only a small proportion of rainwater is reused in the city, which affects the city's degree of adaptation to climate change. This is influenced by factors such as: the dispersion of responsibility for rainwater management for various entities (in particular, for management of rainwater infrastructure), a high degree of land sealing, especially in inner city districts, lack of legal provisions and a systemic solution to oblige investors to apply solutions ensuring retention and management of rainwater on investment sites, while at the same time there is a strong investment and urbanisation pressure on almost all areas, a low degree of implementing rainwater drainage solutions, lack of standards concerning retention and management of rainwater.

   **Actions to be taken:**

   a. implementing the Warsaw Green Building Standard currently being developed for new and modernised city buildings, an important element of which is the requirement to manage rainwater or snowmelt on site,

   b. implementing legislation at national level obliging investors to take advantage of solutions to ensure retention and management of rainwater or snowmelt on investment sites,

   c. intensifying efforts to unseal city-owned impervious surfaces in the districts covered by the Climate City Contract,

   d. intensification of educational activities, using the "Warsaw Climate Change Adaptation Handbook" addressed to property owners, cooperatives, housing communities in the districts covered by the Climate City Contract.

8. **System barriers to RES development**. The development of renewable energy sources in cities faces many systemic barriers in Poland. These include formal and legal barriers such as: the lack of stable legal regulations and a long-term development strategy, which leads to investment uncertainty, the so-called "distance criterion" in the Wind Power Investment Act, which prevents windmills from being built in more densely built-up areas, the lack of legal possibilities to establish energy cooperatives in urban municipalities, the unfavourable billing of electricity supplied to the National Grid for prosumers. There are also infrastructural barriers, such as constraints for prosumers related to their ability to access connection capacities due to the lack of adequate infrastructure (especially in terms of transmission networks). Such barriers discourage or even prevent investment in RES. In the case of photovoltaics, they make it most profitable to produce for self-consumption at the point of generation and it is not profitable to produce surplus energy. In the case of wind energy, they prevent the construction of windmills in an urban or peri-urban area.

   **Actions to be taken:**

   a. legislative changes at the national level, including a reduction of the so-called "distance criterion" in the Wind Power Investment Act, allowing for establishing energy cooperatives in urban municipalities, a more favourable energy billing system for prosumers.

b. the emergence of stable legal regulations and a long-term strategy for the development of renewable energy sources at national level.

9. **Financial barriers**. Systemic transformation requires a great amount of financial resources, which cannot be covered by local authorities. Therefore, the most costly changes have to be carried out using external funds: regional, central, EU, foreign, and private. Access to current funding programmes is severely limited by the dispersion of funding programmes, the complicated application procedure, and rigid nature of the procedures, the narrow scope of the programmes (they are targeted at specific activities, comprehensive transformation activities require the use of multiple programmes with different application and settlement rules), the lack of an adequate number of qualified staff at the City of Warsaw to process applications and implement projects, and, in particular, the statutory restrictions on local government indebtedness, limiting the use of loans.

   **Actions to be taken:**

   a. facilitating access to national and EU funding programmes by: simplifying application procedures, more comprehensive funding programmes and their modular design allowing flexible use of various programme options, launching a counselling system to support local authorities in the process of obtaining and accounting for grants, adapting funding programmes to the real needs and constraints found in EU member states.

   b. increasing the level of private capital involvement in public investment in the city through the use of public-private partnerships (PPP), the Energy Service Company (ESCO) formula, or by setting up funds dedicated to various activities, e.g. Sustainable Energy Investment Fund - along the lines of the city's existing Green Fund.

10. **The unknown scale of energy poverty.** The scale of energy poverty is not precisely known and its proper diagnosis is not easy to carry out. This measure is still being analysed. Without a thorough knowledge of the nature and scale of the phenomenon, it will be difficult to create effective support programmes.

    Key factors contributing to energy poverty are low energy efficiency in buildings, insufficient income to cover energy costs, and rising energy prices. It is estimated that in Poland, 12% of the population is affected by this phenomenon. In Warsaw, energy poverty is exacerbated by the higher cost of living and legal problems related to the status of property ownership, which hinder significant investment in building upgrades. Therefore, the level of energy poverty in the city reaches 15%. Of the districts implementing the Climate Climate Contract, the Praga-Południe district is particularly affected, with serious challenges due to outdated heating systems and reliance on expensive electric heating.

    Initial analyses concerning the phenomenon of energy poverty have been carried out in Warsaw in terms of a project conducted by the Infrastructure Department of the City of Warsaw named The Sun4All, developed within the framework of the European Sun4All project - "Eurosolar for all: energy communities for a fair energy transition in Europe".

    **Actions to be taken:**

    a. performing a thorough analysis of the scale and specifics of energy poverty in Warsaw, starting with the districts covered by the Climate City Contract,

    b. designing public policies (at national, regional and local level) so that they can alleviate energy poverty by improving the energy efficiency of buildings, promoting renewable

energy sources, developing energy communities, and promoting decentralised and democratised energy production and consumption,

c. removing legal barriers at national level that restrict the development of energy communities,

d. developing targeted financial support programmes for low-income households,

e. expert support in obtaining funding, appropriate investment selection and matching energy community models are tailored to local conditions.

**A-3.2: Systems and stakeholder mapping**

| System | Stakeholder | Stakeholder impact on the city's climate neutrality ambitions | Interest in the city's climate neutrality ambition. |
|---|---|---|---|
| **Technology and Infrastructure** | Miejskie Zakłady Autobusowe sp. z o. o. | medium - mainly for the implementation of emission reductions | It undertakes measures to upgrade the entire rolling stock to electric and hydrogen. |
| | Tramwaje Warszawskie sp. z o. o. | medium - mainly for the implementation of emission reductions | Undertakes measures to upgrade the entire rolling stock to more energy efficient ones |
| | Metro Warszawskie sp. z o.o. | medium - mainly for the implementation of emission reductions | Undertakes measures that will contribute to the goal of increasing the comfort and accessibility of low-carbon urban transport - 3 more metro lines planned, one of them in the Praga-Południe district |
| | Miejskie Przedsiębiorstwo Oczyszczania w m.st. Warszawie Sp. z o.o. | medium - mainly for implementing emission reductions | Plans measures to minimise the city's emissions impact - upgrading the entire vehicle fleet to electric |
| | Miejskie Przedsiębiorstwo Wodociągów i Kanalizacji w m.st. Warszawa S.A. | large - to reduce emissions | The first municipal company to have the striving for energy self-sufficiency included in its objectives. It is currently at the stage of preparing a strategic plan, which will include specific recommendations concerning Bioclimatic activities related to both the company's core business of providing water supply |

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| | | | and collecting wastewater from the city's residents as well as other private and public entities. It has one of the most modern and largest sewage treatment plants in Europe. Equipment for the recovery and thermal treatment of sewage waste in cogeneration as well as small-scale photovoltaic farms. It plans to expand these activities. |
| | PKP S.A. | Large - to reduce emissions from transport | State-owned rail network operator. Part of the line runs through the Praga-Południe district. On a city scale, it provides long-distance regional, national, and international rail transport links. It contributes to the metropolitan rail network and is part of the city's transport network improving the comfort and accessibility of public transport for residents. There is no closer cooperation. |
| | Mazowiecka Agencja Energetyczna sp. z o.o. | Moderate - analyses of the region's energy system including Warsaw | It cooperates with Warsaw in terms of carrying out expert reports and analyses concerning the Energy and buildings sectors - there is potential for collaboration. |
| | PGNiG Termika /Orlen | Very large - concerning emissions from heat and power generation, emissions, from buildings | A state-owned energy group that owns thermal power plants in Warsaw that produce heat and electricity based on fossil fuels. The modernisation does not depend on Warsaw. Due to the political change in the country, there is the potential to work with the operator, yet to be established. |
| | Veolia Energia Warszawa S.A. | Large – for emissions from heat and power generation, emissions from buildings | Heat distributor in the city, owner of part of the heating network. There is cooperation and a desire to modernise the network in a direction that supports the climate transition. |
| | Stoen Operator Sp. z o.o. | Large – concerning emissions from heat and power generation, | Heat distributor in the city, owner of part of the heating network. There is cooperation and a desire to modernise the |

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|---|---|---|---|
| | | emissions from buildings | network in a direction that supports the climate transition. |
| | LOTTE Wedel sp. Z o.o. | Moderate – concerning emissions from manufacturing, industry | A manufacturer of sweets in the Praga-Południe district – a factory that is keen to cooperate and supports the city's striving for climate neutrality. |
| | PL.2012 Sp. z o.o. (Manager of PGE Narodowy) | Moderate – in terms of energy consumption, emission reductions | National Stadium – the largest venue in Poland. It is located in the Praga-Południe district, one of the largest facilities whose energy efficiency improvements and reductions in energy consumption and emissions can bring local and city-wide benefits. No cooperation so far. |
| | PIT-RADWAR S.A. (Polish Armaments Group) | Small – concerning reducing emissions | A local business in the district, one of the larger ones whose reduction of emissions can bring local and city-wide benefits. |
| | KONSBUD AUDIO sp. z o.o. | Small – concerning reducing emissions | A local business in the district, one of the larger ones, whose reduction of emissions can bring local and city-wide benefits. |
| | Orbis S.A. (Hotel Ibis Ostrobramska) | Moderate – concerning emission reduction, indirectly for public education | The Accor hotel group, which over a decade ago adopted the Planet21 internal ecological programme aiming to reduce the carbon footprint of its hotels globally. In Warsaw, it represents the potential for replication in more than a dozen sites across the city. It encourages and educates its guests in terms of the ecological use of resources during their stays in the group's hotels. |
| | Polska Wytwórnia Papierów Wartościowych S.A. (facility at ul. Karczunkowska 30) | Small – concerning emissions from buildings, transport, industry | The largest such plant in Poland, it operates one of its plants in the district. |
| | Danfoss Poland Sp. z o.o. | Moderate – concerning | The Danish company willingly shares its know-how and has been cooperating with Warsaw and the Danish Embassy for many years in terms of supporting and |

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| | | emissions from buildings, heating | demonstrating innovative energy-efficient technologies in production processes and buildings. |
| **Governance and Policy** | Warsaw City Council / District Councils | Very large – it makes decisions concerning the main activities of the city/district, including strategies and budget. | It passed a resolution to adopt a city road map indicating actions leading to climate neutrality – the Green Vision for Warsaw (GCAPP). It is a political body and therefore represents various points of view concerning the urgency of pro-climate action among councillors |
| | Ministry of Climate and Environment | Very large – introduces legislation and has funds directed towards environmental and climate protection | After a period of hostility to the issue of climate neutrality and decarbonisation, it actively engages with cities and undertakes a range of activities supporting cities and declares further systemic cooperation in terms of a national platform (also as part of the CapaCities project), which manifests itself through an open dialogue on, among other things, barriers to implementing cities' pro-climate goals |
| | Ministry of Infrastructure | Large – introduces legislation and has funds directed to infrastructure and system operations in this area | It participates in the operations of a cooperation platform between government and local government. It takes part in an open dialogue coordinated by the Ministry of Climate and Environment. |
| | Ministry of Development Funds and Regional Policy | Very large – introduces legislation and has funds directed towards climate tasks | It has an impact on the possibility of implementing pro-climate projects and investments in Warsaw as well as reductions in all emission sectors. |
| | Marshal's Office of the Mazowieckie Voivodeship | Large – introduces legislation and has funds directed towards climate tasks | It has an impact on the possibility of implementing pro-climate projects and investments in Warsaw as well as reductions in all emission sectors. |
| | Warsaw Metropolis Association | Very large – on directions of action and priorities | It prepares and coordinates the implementation of the metropolitan strategy – promotes pro-climate measures |

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| | | among municipalities in the Warsaw Metropolis | among the municipalities of the metropolis, supports e.g. the development of a coherent transport system, a blue-green infrastructure system, etc. |
| | Embassy of the Kingdom of Denmark in Poland | Moderate – it offers expertise, know-how, support in preparing investment documentation | In terms of issues concerning climate change, the cooperation has been intensifying for several years. |
| | US Embassy in Poland | Moderate – offers substantive support and opportunities for economic, scientific, and advisory cooperation. | It is happy to support projects and invites to cooperate in the energy, construction, emissions analysis, data analysis, strategic expertise sectors. The potential for cooperation is apparent, but language and relatively poor knowledge of Polish realities sometimes becomes an issue for the City of Warsaw. |
| **Education** | SWPS University | Moderate – one of the 5 largest universities in Warsaw, has a permanent cooperation agreement with Warsaw | It implements pro-climate projects, including the Green University Strategy adopted in 2024. It integrates climate issues with the other fields of study it pursues. Co Design4Transition is currently underway with Warsaw - dedicated to scientific research (doctoral theses) concerning the Systemic social innovation linked to the social conflicts triggered by the climate crisis and its consequences. The needs of the city and the capabilities of the university are much greater than the cooperation to date - the limitations most often consist in funding and a lack of staff resources on the city's side. |
| | Warsaw University of Life Sciences | Moderate – one of the 5 largest universities in Warsaw, has a permanent cooperation agreement with Warsaw | It carried out, and still does, a number of projects in cooperation with Warsaw, e.g. concerning climate change adaptation and cooperation with local communities, new technologies in the building sector, energy storage, etc. The needs of the city and the capabilities of the university are much greater than the cooperation to date – the limitations most often consist in |

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| | | | funding and a lack of staff resources on the city's side. |
| | CEZAMAT Centre for Advanced Materials and Technologies of the Warsaw University of Technology | Small – a unit of one of the 5 largest universities in Warsaw, which has a permanent cooperation agreement with Warsaw | The Warsaw University of Technology has carried out, and still does, a number of projects in collaboration with Warsaw, e.g. concerning Modernising buildings, unsealing surfaces, greening the city, etc.<br>E.g. Engineers of the New Generation, Competitions and Theses by Students of the Climate Crisis Architecture Research Club. Seeking optimal, innovative, solutions or applying BAT in unconventional and most effective ways. The needs of the city and the capabilities of the university are much greater than the cooperation to date - the limitations most often consist in funding and a lack of staff resources on the city's side. |
| | University of Warsaw | Moderate – one of the 5 largest universities in Warsaw, has a permanent cooperation agreement with Warsaw | The University of Warsaw carried out, and still does, a number of projects in cooperation with Warsaw, e.g. concerning Spatial studies, including diagnoses and analyses of the urban heat island, the blue-green infrastructure system, etc. It provides know-how and expertise to the city and is keen to collaborate at the level of research dedicated to the city, including being involved in supporting the preparation of the CCC. The needs of the city and the capabilities of the university are much greater than the cooperation to date - the limitations most often consist in funding and a lack of staff resources on the city's side. |
| | Institute for Environmental Protection PIB | Large – in terms of know-how, expertise, and high-quality climate analyses | It has a long-standing relationship with Warsaw in terms of tackling the climate crisis. It actively participates in and initiates the building of a platform for cooperation between the government and local government sectors. The central environmental and climate scientific institution - the Climate and Adaptation Research Centre, under the Ministry of Climate and Environment. It runs a |

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| | | | climate knowledge portal based on IPCC reports - Klimada 2.0. |
| **Finances** | Ministry of Development Funds and Regional Policy | Very large – operates foreign funds in Poland and creates regional and national support programmes | It defines the scope of support programmes and allocates EU and foreign funds to specific types of activities and beneficiaries. It participates in dialogue with local authorities as part of the Ministry of Climate and Environment's cooperation with the Polish Cities Mission. It has a great potential to support both local governments and the private sector in their efforts to achieve climate neutrality. |
| | Marshal's Office of the Mazowieckie Voivodeship | Large – introduces legislation and has funds directed towards climate tasks | It has an impact on the possibility of implementing pro-climate projects and investments in Warsaw as well as reductions in all emission sectors. |
| | National Environmental Protection Fund and Provincial Environmental Protection Fund in Warsaw | very large | The only such institution on a global scale that provides funding to various actors for environmental and climate protection measures – thus providing real support to both local governments and the private sector, the scientific sector. It participates in an open dialogue with local governments on how to support them in their tasks of achieving climate neutrality, which can offer the potential to adapt financial tools and support programmes to the real needs of local authorities. It reports to the Ministry of Climate and Environment. |
| **Social** | Energy Forum Foundation | Large – by providing know-how and data analysis, as well as tools and solutions to help with, among other things, diagnoses and planning of pro-climate measures. | It terms of, for example, the LeadAir project, Warsaw has been working with the Energy Forum since 2021, which supports cities in creating so called Energy transition maps as well as provides knowledge and helps to analyse the situation of cities on the basis of reliable data, using external funding without overburdening the budget. |

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| | Association of Polish Cities | Moderate – represents more than 330 cities in Poland, for example, before national institutions | It conducts dialogue, participates in legislative processes with the government side representing cities. It has a Climate Committee and an Environmental Commission develop city positions and proposals for action for the government side in support of, among other things, the climate transformation of cities. |
| | Sendzimir Foundation | Moderate – supports local authorities in implementing pilot, innovative, and demonstration projects | It realistically supports local authorities in implementing pilot, innovative, and demonstration projects, e.g. in the fields of construction, blue-green infrastructure, lighting, and water management. It has a wide cooperation network |
| **Education** | Foundation for Climate Education (Nauka o Klimacie Portal) | Moderate – seeks to have an impact on raising the awareness among the public and spheres of government. | An institution that disseminates reliable knowledge concerning the climate and the phenomena associated with its change. It disseminates, for example, IPCC reports in Polish, fights climate disinformation, and seeks to enter into dialogue with government, local government, and the private sector. |
| | Sendzimir Foundation | Moderate – supports local authorities in implementing pilot, innovative, and demonstration projects | It realistically supports local authorities in implementing pilot, innovative, and demonstration projects, e.g. in the fields of construction, blue-green infrastructure, lighting, and water management. It has a wide cooperation network |

**A-3.3: Description or visualisation of the participatory model of climate neutrality of the city**

The GHG inventory of Warsaw, for the years 2018, 2020, 2022, shows that the share of municipal units in the emissions of the entire Warsaw oscillated at approx. 7.5% (concerns emission scope 1 and 2). Therefore, a key factor for success in achieving the goal of the Climate City Contract is to involve the widest possible range of stakeholders.

In the process of implementing the CCC, we want to build on our previous good experiences, adding to them the experience and knowledge we have gained in the course of implementing the measures: from

our project partners, advisors, other cities, stakeholders, etc. We also want to extend the involvement of stakeholders and residents throughout the process.

In this regard we will take advantage of our extensive experience from past participatory and consultative processes. Warsaw has been involving residents and stakeholders in important decision-making processes for many years through:

- Consulting residents and stakeholders on key plans and actions. Since 2010, **2353 public consultations** have taken place in Warsaw. Current information concerning them can be found at the dedicated website (https://konsultacje.um.warszawa.pl)
- Extensive **consultation with residents and other stakeholders concerning documents programming the city's development** and important projects affecting quality of life, such as: the Climate Change Adaptation Strategy for Warsaw by 2030 with a perspective to 2050. The Municipal Adaptation Plan, Study of Conditions and Directions of Spatial Development of Warsaw, Clean Transport Zone, revitalisation programmes, Local Spatial Development Plans, etc.
- Participation in developing **the Green Vision for Warsaw (GCCAP)**. We've invited a wide range of stakeholders who had a significant impact on the final character of the document: representatives of NGOs, science, and businesses. Experts from various fields and residents of the capital were also involved in the work. More than 20 working meetings and workshops for external stakeholders took place, as well as dozens of sessions for internal stakeholders - municipal units and units responsible for implementing individual measures. Approx. 300 people participated in them. Residents of Warsaw had also the opportunity to submit their comments on the document via a virtual platform.
- Between 2020 and 2021, Warsaw organised **the Warsaw Climate Panel**, which was commissioned to NGOs selected in the course of a competition, and 90 residents selected at random (representative of the city's social structure in terms of age, gender, education, residence) decided on climate policy in the area of increasing Warsaw's energy efficiency and the share of renewable energy sources in the city's energy balance. The panellists developed and voted on 49 recommendations for Warsaw. The panel also included experts, representatives of NGOs and urban movements. Implementing the Panel's provisions is monitored by the Monitoring Team, which includes the social side.
- For more than 10 years, Warsaw includes the institution of the **Participatory budgeting**, a process in which the residents of Warsaw decide what to spend part of the city budget on. They submit their ideas and then, by voting, select those to be implemented by the City of Warsaw.
- For many years, the city has had a platform called **Partnership for Climate**, which brings together organisations and institutions representing a wide variety of backgrounds, including state and local government units, embassies, businesses, NGOs and institutions committed to nature conservation and building a sustainable city. Members of the platform share knowledge, experiences, and carry out joint projects.

# 3. Part B – Pathways to achieve climate neutrality by 2030

## 3.1 Module B-1 Climate neutrality scenarios and impact pathways

| **B-1.1: Impact pathways** | | | | | |
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| Impact sector | System levers | Early changes (1-2 years) | Late changes (3-4 years) | Direct impact (emission reductions) | Indirect impact (co-benefits) |
| Energy system | Technology/infrastructure | Green energy purchasing | Decarbonisation of the electricity system and investment in RES generation | Reduction in districts: 377,575.36 t CO2e | Reduction of the city's CO2e emissions.<br>Improving air quality.<br>Strengthening the city's energy security. |
| | | Extending the heating network coverage | Developing the electricity infrastructure in the city, energy storage, SmartGRID smart grid management system | | |
| Buildings and heating | Technology/<br>Infrastructure/Governance and Politics/Science/Finance and Funding/Social/<br>behaviour/ education/ spatial planning | New energy-efficient municipal buildings | Decarbonisation of the heating system | Reduction for districts: 748,963.81 t CO2e | Reduction of the city's CO2 emissions<br>Strengthening the city's energy security.<br>Improving the resilience of buildings to the effects of climate change and protecting the health of residents.<br>Improving the residents' quality of life.<br>Financial savings. |
| | | Modernisation of municipal buildings | Using waste heat to reduce system heat production.<br>Engaging private capital in PPP, Esco, and other legally available forms. | | |
| | | Energy-efficient lighting | New or upgraded energy-efficient indoor and outdoor lighting in private buildings and municipal buildings. | | |
| Transport | Technology/<br>Infrastructure/ Governance and | Development of public transport | Reduced demand for motorised passenger transport and a shift towards | Reduction for districts: | 1. Improving air quality. |

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| | Policy/Science/ Finance and Funding/ Social/ behaviour/ education/ spatial planning | | public and non-motorised transport | 247,247,489.09 t CO2e | 2. Improving the residents' quality of life.<br>3. Increased road safety.<br>4. Introducing the idea of a 15-minute city and community - improving the accessibility of city services for the residents of the two districts of Praga-Południe and Ursynów. 5. Improving the effectiveness of implementing pro-climate measures.<br>6. Developing competencies in the local government and among cooperating stakeholders.<br>7. Reducing costs and improving the financial situation of the local authority.<br>8. Supporting the engagement of the private sector. |
| | | Developing the pedestrian and bicycle infrastructure | Building a coherent system of bicycle and pedestrian routes. Increasing infrastructure by 20%. | | |
| | | Measures to decarbonise road transport | Increased carsharing.<br>Reduced car traffic. Increased electrification of transport modes from the private sector, participation in funding.<br>Implementing SCT. | | |
| Green infrastructure and nature-based solutions | Technology/ Infrastructure/Governance and Policy/Science/Finance/Social/ behaviour/ education/ Spatial planning | Developing blue-green infrastructure in the city<br>. | Increasing the number of residents with quick access to green spaces (within 500m) to 90%.<br>Improving the quality of green spaces as well as increasing their value and quality of ecosystem services.<br>Creating a coherent monitoring system for adaptation measures.<br>An increase in the number of grants for residents and private sector co-funding of green spaces.<br>Increased support for adaptation measures among | Reduction for districts: 175,200.00 t CO2e | Reduction of $CO_2$ emissions.<br>Improving air quality.<br>Improving the microclimate.<br>Lowering the temperature and increasing the humidity.<br>Improving the residents' quality of life.<br>Water consumption savings.<br>Supporting the development of biodiversity.<br>Including the activities of the Climate Change Adaptation Mission into the CCC. |

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| | | | residents and the private sector. | | |
| Waste management and GOZ | Technology/<br>Infrastructure/ Governance and barriers<br>/Science/Finance and Funding/ | Circular municipal economy | Investments in solutions allowing to achieve the required recovery and recycling levels.<br>Developing urban biogas plants. | Reduction for districts: 5,600 tCO2e | Reduction of consumption-based emissions.<br>Strengthening the city's energy security. |

**B-1.2: Description of impact pathways**

The selection of impact pathways is based on 3 sources: The Green Vision of Warsaw (GCAAP), developed based on data collected in terms of the State of the City Analysis (124 indicators of environmental pressure), based on the results of the greenhouse gas inventory (for 2018-2022) and based on the predictions of the economic model (an integrated tool supporting the climate transition planning process, enabling data-driven strategic decision-making). We've put emphasis on measures that will bring the most tangible effects in the form of a quick reduction of $CO_2$.

According to the results of the latest GHG inventory (for 2022), Warsaw's dominant sector, in terms of emissions, consists in stationary energy (electricity and heat production and consumption by buildings), which accounts for 73% of the city's total emissions. Another key sector is transport, which accounts for 26% of Warsaw's emissions.

The above results in the strategic, systemic priorities for achieving the 2030 reduction target by the mission districts that have been outlined in the Commitments. They are:

1. Changing the energy mix structure - replacing fossil energy sources in the area of electricity and heat production and distribution with low-carbon renewable sources.
2. Reducing the need for heat and electricity from fossil sources.
3. Increasing the level of electrifying public transport and reducing the scale of individual car transport.
4. Developing blue-green infrastructure.

All priorities are reflected in the impact pathways. The three initial priorities concern the most effective manners of influencing the reduction of emission levels in the specific situation of Warsaw. Priority 4 is less relevant in terms of direct impact on emission reductions. However, maintaining and developing blue-green infrastructure is very important both in terms of sequestering surplus carbon, as well as adaptation measures to increase the city's resilience to the effects of climate change and increasing access for residents to recreational areas. The list of priorities did not include waste management due to its low contribution to the city's greenhouse gas emissions.

However, it is included on the list of impact pathways due to its significance for the circular economy and indirect impact on emissions. Sectors such as agriculture and industrial processes were not included among the priorities or pathways, as the impact of these sectors on Warsaw's overall emissions is traceable - on the verge of statistical error.

## 3.2 Module B-2 Designing a climate neutral portfolio

Below is a description of the portfolio of actions leading to achieving the reduction targets of the Climate City Contract and an outline of the individual actions that correspond to the defined priorities. Additionally, at the end of this section, there is a description of the portfolio of supporting actions that need to be implemented in order to support reduction efforts, to take care of important issues such as a just transition and the elimination of systemic barriers. In this version of the document, the support measures are described at a general level, because a large part of them have yet to be developed. In subsequent iterations of the document, the actions will be detailed.

| **B-2.1: Description of the climate neutrality portfolio** | | |
|---|---|---|
| Impact sector | Portfolio description | |
| | List of actions | Description |
| Energy system | Electricity production | Taking action in terms of:<br>• purchasing Green energy by municipal entities (E-1),<br>• decarbonising the heating and electricity system as well as the renewable electricity generation by the city within and outside its borders (E-2),<br>• using waste heat to reduce system heat production (E-3),<br>• developing electricity storage facilities (E-4),<br>• developing the city's electrical power infrastructure - SmartGRID (E-5) smart grid management system,<br>• decarbonising local heat networks/sources (E-6),<br>• modernising outdoor urban lighting by using energy-efficient LED luminaires and implementing smart energy control systems (E-7). |
| Buildings and heating | Modernising the building and heating sector to decarbonise and increase energy efficiency and | Taking action in the areas of:<br>• deep thermal modernisation of (municipal and private) residential and commercial buildings (B-1, B -2, B-3), |

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| | improve the quality of life for residents | • implementing smart energy management systems in municipal and private residential and commercial buildings (B-1, B-2),<br>• installing renewable energy sources (electricity and heat) in (municipal and private) residential and commercial buildings (B-1, B-2),<br>• designing and constructing new urban commercial and residential buildings to high energy efficiency standards (B-3, B-4),<br>• decarbonising the district heating and electrical power system as well as renewable electricity generation by the city within and outside its boundaries (E-2). |
| Transport | Private and urban transport within the city | Taking action in terms of:<br>• developing pedestrian and bicycle infrastructure (T-1),<br>• developing public transport (T-2),<br>• decarbonising car transport and building charging stations for electric vehicles (T-3). |
| Green infrastructure and nature-based solutions | Maintaining and developing urban green areas as part of Warsaw's coherent blue-green infrastructure system | Taking action in terms of:<br>• developing the blue-green infrastructure network (G-1),<br>• increasing the area of green spaces (G-2),<br>• blue-green infrastructure and nature-based solutions - Nbs (G-3),<br>• implementing sustainable rainwater management systems (G-4),<br>• protecting valuable habitats and ensuring the coherence, continuity, and development of blue-green infrastructure (G-5) |
| Waste management and GOZ | Strengthening and developing the circular municipal economy and further development of investments in waste disposal. | Taking action in terms of:<br>• preventing and reducing waste, in line with the idea of a circular economy (W-1),<br>• improving the quality of selective collection at the source and increasing the amount of selectively collected waste (W-2),<br>• implementing investments in solutions allowing to achieve recovery and recycling levels (W-3),<br>• implementing investments involving the construction of further municipal biogas plants (W-4). |

## B-2.2: Outline of individual actions

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| Description of actions | Action name | Action E-1<br>**Purchasing "Green energy" by municipal entities** |
| | Type of action | Infrastructure, education, support measures, funding |
| | Description of actions | Examples of actions to be implemented:<br>a. purchase of energy from renewable energy sources with a guarantee of origin for consumption by municipal entities,<br>b. purchase of energy from renewable energy sources with a guarantee of origin for the operation of urban infrastructure, i.e. lighting, consumption in municipal buildings, public transport and traction purposes, the operation of technical facilities. |
| Reference to impact pathways | Impact sector | Energy system |
| | System lever | Technology and infrastructure, governance and policy, finance and funding |
| | Impact (with reference to module B-1.1) | Using "Green energy" with a guarantee of origin reduces the city's greenhouse gas emissions AND increases the share of RES in the energy balance for which the city is responsible. |
| Implementation | Units/persons responsible for the implementation | City of Warsaw - Infrastructure Department, District Offices and Municipal Units |
| | Scale of action and entities covered | Covers the entire project area. Activities carried out by municipal units that carry out energy purchasing for the entire city. This action will be implemented at a city-wide level as well as outside the immediate contract area but will have a direct impact on it. |
| | Involved stakeholders | City of Warsaw, District Offices, city companies |
| | Comments concerning implementation – resources needed, timetable and milestones | Some of the necessary activities are market-driven and not subject to local regulation. Purchasing green energy requires undertaking action by the city and, in particular, encouraging municipal companies to allocate their financial resources for this purpose. |
| Receipts and costs | Generated renewable energy (if applicable) | Not applicable |
| | Energy removed/replaced, amount or type of fuel | Fossil Fuel |

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| | Estimated greenhouse gas emission reductions for each emission source sector | 61,902 tCO2/year |
| | Compensated greenhouse gas emissions (carbon dioxide absorbed) | Not applicable |
| | Total and unit (per unit $CO_2e$) costs | only OPEX PLN 27,965,250 PLN / EUR 6,214,500.00<br>451 PLN/tCO2 / 100 EUR/tCO2e |

| **B-2.2: Outline of individual actions** | | |
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| Description of actions | Action name | Action E-2<br>**Decarbonising the heating and electrical power system as well as generating electricity from renewable sources by the city within and outside its boundaries** |
| | Type of action | Infrastructure, education, support measures, funding |
| | Description of actions | Examples of actions to be implemented in the Energy System sector:<br>a. investments in renewable energy sources in Warsaw, such as large-scale photovoltaics, using biogas, hydrogen production, and low-temperature geothermal energy. Using city-owned land and city companies for this purpose.<br>Examples of actions to be carried out in the Buildings and Heating sector:<br>a. analysis of the potential and use of high-temperature geothermal energy<br>b. working with energy suppliers to decarbonise the district heating sector and move towards RES at source,<br>c. developing local low-temperature heating systems located in selected districts of the city<br>d. extending the reach of the heating network and connecting new customers to an efficient heating system |
| Reference to impact pathways | Impact sector | Energy system, Buildings and heating |
| | System lever | Technology and infrastructure, governance and policy, finance and funding |

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| | Impact (with reference to module B-1.1) | Investment in renewable energy generation, which is zero-carbon and reduces the city's CO2 emissions balance. Undertaking decarbonisation measures in collaboration with energy companies will enable a shift away from or a significant reduction in the fossil fuels currently used in the city's energy industry, resulting in a significant reduction in emissions within the city limits. |
| Implementation | Units/persons responsible for the implementation | City of Warsaw - Infrastructure Department, District Offices and Municipal Units |
| | Scale of action and entities covered | Covers the entire project area. Actions carried out by municipal units. This action will be implemented at a city-wide level and outside the immediate contract area, but will have an impact on it. |
| | Involved stakeholders | City of Warsaw, district offices, municipal companies |
| | Comments concerning implementation – resourcees needed, timetable and milestones | Investment in measures aimed at decarbonising the energy industry, which at the moment is largely based on fossil fuels such as coal (75%), natural gas and fuel oil, are actions with a very high impact on the city's final reduction target. Using renewable sources as much as possible by switching to RES at source or building low-temperature heating systems will significantly reduce emissions and improve air quality.<br><br>The action of developing a heating network requires a lot of financial resources. Developing the heating network in new investment areas is often uneconomic or infeasible due to the dispersal of customers or the cost recovery of its implementation. However, developing this network in highly urbanised areas is also hampered by the technical complexity of the solutions and the necessary interference with existing infrastructure.<br><br>Furthermore, developing small district heating networks based on local heat pump-fired boiler houses provides an alternative for all those areas of the city where the district heating network does not reach or where there are fossil fuel-fired boiler houses.<br><br>The actions may include, for example, constructing new sections of the heating network and new heat connections, constructing modern individual single and double-function heat substations, liquidating |

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| | | group exchanger stations, liquidating external consumer installations (low-pressure networks) of central heating and hot water, made using the traditional canal method, installing telemetric stations in individual heat substations (remote monitoring of substation operation control), constructing and expanding a telemetry system in heat chambers and constructing a telemechanics system enabling remote management of network traffic, constructing a system for remotely supervising pipeline alarm installation, including constructing remote supervision points, modernising and expanding a system for remote reading of heat measurement systems, integrating data from the above systems to support the remote management of the heating system. |
| Receipts and costs | Generated renewable energy (if applicable) | RES capacity - 27 MW in 2025<br>RES capacity - 135 MW in 2030.<br>2,043,934.5 MWh renewable energy substituted for district heating and electricity system development |
| | Energy removed/replaced, amount or type of fuel | Coal |
| | Estimated greenhouse gas emission reductions for each emission source sector | 632,700 tCO2e in total resulting in 399,866.40 tCO2e for district heating development and 232,833.60 tCO2e for decarbonising the electricity system |
| | Compensated greenhouse gas emissions (carbon dioxide absorbed) | Not applicable |
| | Total and unit (per unit $CO_2e$) costs | PLN 110,358,000 / EUR 24,524,000 (Przedinwest.+CAPEX+OPEX)<br>174 PLN/tCO2 / 38 EUR/tCO2 |

| **B-2.2: Outline of individual actions** | | |
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| Description of actions | Action name | Action E -3<br>**Using waste heat to reduce system heat production** |
| | Type of action | Infrastructure, education, support measures, funding |
| | Description of actions | Examples of actions to be implemented:<br>a. studying the potential and use of waste heat (from industrial processes, refrigeration processes, subways, server |

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| | | rooms) to locally increase the temperature of system heat from combined heat and power plants. |
| Reference to impact pathways | Impact sector | Buildings and heating |
| | System lever | Technology and infrastructure, governance and policy, finance and funding |
| | Impact (with reference to module B-1.1) | The use of waste heat, which is the largest unused heat buffer there is in the city, can contribute to a significant reduction in the heat energy produced by the city's existing combined heat and power plants. |
| Implementation | Units/persons responsible for the implementation | City of Warsaw - Infrastructure Department, District Offices and Municipal Units |
| | Scale of action and entities covered | Covers the entire project area. Actions carried out by municipal entities, municipal companies, large industrial plants, private entrepreneurs. This action will be implemented at a city-wide level and outside the contract area, but will have a direct impact on it. |
| | Involved stakeholders | City of Warsaw, district authorities, city companies, large industrial plants, private entrepreneurs |
| | Comments concerning implementation – resources needed, timetable and milestones | Waste heat (from industrial processes, refrigeration processes, subways, server rooms) can be used locally to raise the temperature of the heating medium in district heating network pipelines. This would mean a reduction in producing system heat from fossil fuel sources located within the city. However, this action requires a very strong involvement of external actors such as large industrial plants with such waste heat and their cooperation on many levels with the city. Such actions generate great costs concerning the construction of heat exchangers and building district heating plants. In this regard there is a need for regulation at the national level to make it profitable for these actors to invest in such solutions. |
| Receipts and costs | Generated renewable energy (if applicable) | Not applicable |
| | Energy removed/replaced, amount or type of fuel | Fossil Fuel |
| | Estimated greenhouse gas emission reductions for each emission source sector | 79,920.00 tCO2 (concerns local low-temperature networks, potential study does not result in reduction) |

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| | Compensated greenhouse gas emissions (carbon dioxide absorbed) | Not applicable |
| | Total and unit (per unit $CO_2e$) costs | No data |

| **B-2.2: Outline of individual actions** | | |
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| Description of actions | Action name | Action E- 4<br>**Developing electricity storage** |
| | Type of action | Infrastructure, education, support measures, funding |
| | Description of actions | Examples of actions to be implemented:<br>a. creating storage systems for energy generated from renewable sources to balance energy production and consumption |
| Reference to impact pathways | Impact sector | Energy system |
| | System lever | Technology and infrastructure, governance and policy, finance and funding |
| | Impact (with reference to module B-1.1) | Using renewable energy storage facilities |
| Implementation | Units/persons responsible for the implementation | City of Warsaw - Infrastructure Department, District Offices and Municipal Units |
| | Scale of action and entities covered | Covers the entire project area. Actions carried out by municipal entities, private entrepreneurs. This action will be implemented at a city-wide level and outside the contract area, but will have a direct impact on it. |
| | Involved stakeholders | City of Warsaw, district offices, city companies, private entrepreneurs |
| | Comments concerning implementation – resources needed, timetable and milestones | The development of electricity storage should be preceded by an analysis of its use, location, and the capacity required in the current electricity grid. Investments in building local storage facilities for electricity from renewable energy sources can be used as an energy buffer for the city's existing electricity grid and serve primarily to compensate for energy losses occurring on the grid. They require great amounts of financial resources as well as involving private entrepreneurs, who often have surplus unused but produced electricity. |

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| | | What is needed here is a system of incentives and support programmes for those who want to have such energy storage facilities. Following regulatory changes are needed at national level in this area.<br>Stoen Operator Sp. z o.o. currently operates an energy storage facility in Warsaw. An energy storage lithium-ion battery with a capacity of 62 kWh represents a reduction in emissions of 43.4 kgCO2e.<br>Only the existing energy storage facility was used in the calculations, due to the lack of studies concerning the construction of new energy storage facilities in the city. |
| Receipts and costs | Generated renewable energy (if applicable) | Not applicable |
| | Energy removed/replaced, amount or type of fuel | Fossil Fuel |
| | Estimated greenhouse gas emission reductions for each emission source sector | 43.4 kg CO2e / 1 lithium-ion battery with a capacity of 62 KWh /<br>With daily full use of battery capacity, 15,841 kgCO2 |
| | Compensated greenhouse gas emissions (carbon dioxide absorbed) | Not applicable |
| | Total and unit (per unit $CO_2e$) costs | 1 lithium-ion battery with a capacity of more than 50 kWh - PLN 300,000 / EUR 67,000 |

| **B-2.2: Outline of individual actions** | | |
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| Description of actions | Action name | Action E-5<br>**Development of electrical power infrastructure in the city - SmartGRID smart grid management system** |
| | Type of action | Infrastructure, education, support measures, funding |
| | Description of actions | Examples of actions to be implemented:<br>a. the city's grid management system and its further development |
| Reference to impact pathways | Impact sector | Energy system |
| | System lever | Technology and infrastructure, governance and policy, finance and funding |

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| | Impact (with reference to module B-1.1) | Development of electrical power infrastructure in the city |
| Implementation | Units/persons responsible for the implementation | City of Warsaw - Infrastructure Department, District Offices and Municipal Units |
| | Scale of action and entities covered | Covers the entire project area. Actions carried out by municipal entities that implement investments related to developing the city's electrical power infrastructure. This action will be implemented at a city-wide level and outside the contract area, but will have a direct impact on it. |
| | Involved stakeholders | City of Warsaw, District Offices, City Companies |
| | Comments concerning implementation – resources needed, timetable and milestones | Developing the city's electrical power infrastructure constitutes a complex infrastructural undertaking dependent on a number of both technical and financial factors. From the point of view of the increasing use of RES, electrical power grids need to be continuously developed so that they do not break down and are better managed. Implementing smart grid management systems primarily involves using systems to: optimise energy transmission in power operators' networks, supervise energy flow in smart grids, manage local energy storage.<br>In addition, it is used to monitor and control the manner in which energy is distributed (in lines and at substations) and to determine consumer needs, to manage generation sources and to monitor energy flow lines, and to optimise energy flow from a cost and demand perspective.<br>National policies related to network design guidelines, use and development also have an impact on this. |
| Receipts and costs | Generated renewable energy (if applicable) | Not applicable |
| | Energy removed/replaced, amount or type of fuel | Fossil Fuel |
| | Estimated greenhouse gas emission reductions for each emission source sector | 79,380 $tCO_2$/year |
| | Compensated greenhouse gas emissions (carbon dioxide absorbed) | Not applicable |
| | Total and unit (per unit $CO_2e$) costs | No data |

| B-2.2: Outline of individual actions | | |
|---|---|---|
| Description of actions | Action name | Action E - 6<br>**Decarbonisation of local networks/heat sources** |
| | Type of action | Infrastructure, education, support measures, funding |
| | Description of actions | Examples of actions to be implemented:<br>a. introducing a ban on using solid fuels and enforcing it (in accordance with the anti-smog resolution of the Sejmik of the Mazowieckie Voivodeship),<br>b. switching to environmentally friendly heat sources without using fossil fuels<br>c. subsidy programmes for heat pumps, RES. |
| Reference to impact pathways | Impact sector | Buildings and heating |
| | System lever | Technology and infrastructure, governance and policy, finance and funding |
| | Impact (with reference to module B-1.1) | Decarbonisation of local heating networks |
| Implementation | Units/persons responsible for the implementation | City of Warsaw - Air Protection and Climate Policy Department, Infrastructure Department, District Offices and municipal units |
| | Scale of action and entities covered | Covers the entire project area. Actions carried out by municipal entities responsible for the city's climate policy |
| | Involved stakeholders | City of Warsaw, district authorities, residents and entrepreneurs |
| | Comments concerning implementation - resources needed, timetable and milestones | Actions concerning replacing non-environmental heat sources through subsidy programmes targeted at residents and small businesses have a direct impact on reducing the city's CO2 emissions and improving air quality. Low emissions constitute the direct cause of smog in the city and its effects. Subsidy programmes mobilise entities to take action and are an effective form of combating the city's low emissions and can be implemented over many years. They require great amounts of money as well as introducing a system of incentives and educational |

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| | | campaigns for all those interested in replacing their heat source. |
| Receipts and costs | Generated renewable energy (if applicable) | Not applicable |
| | Energy removed/replaced, amount or type of fuel | Fossil Fuel |
| | Estimated greenhouse gas emission reductions for each emission source sector | 7,391 $tCO_2e$ |
| | Compensated greenhouse gas emissions (carbon dioxide absorbed) | Not applicable |
| | Total and unit (per unit $CO_2e$) costs | PLN 9,071,433 / EUR 2,015,874<br>1227 PLN/tCO2e / 272 EUR t/$CO_2$ e |

| **B-2.2: Outline of individual actions** | | |
|---|---|---|
| Description of actions | Action name | Action E-7<br>**Modernising outdoor municipal lighting** |
| | Type of action | Urban infrastructure, direct reduction |
| | Description of actions | The measure consists of modernising outdoor urban lighting (in streets, green areas, including parks) by using energy-efficient LED luminaires and implementing smart energy control systems, which contribute to optimising energy consumption, sustainability and environmental protection (progressive dimming or motion activation, which allow light intensity to be controlled according to the needs). |
| Reference to impact pathways | Impact sector | Energy system |
| | System lever | Technology and infrastructure, governance and policy, finance and funding |
| | Impact (with reference to module B-1.1) | Reduced energy consumption in the city's lighting infrastructure. |
| Implementation | Units/persons responsible for the implementation | City of Warsaw, district offices, municipal entities and companies. |
| | Scale of action and entities covered | Praga-Południe and Ursynów District area: main streets, parks, squares. |

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| | Involved stakeholders | Residents, NGOs, universities, and scientific institutes. |
| | Comments concerning implementation - resources needed, timetable and milestones | At the beginning of 2021, Warsaw signed a contract for the supply of new luminaires using LED technology. The regular replacement of luminaires began in February 2022. Increasing the scale of action in the Praga-Południe and Ursynów districts depends on available funding. |
| Receipts and costs | Generated renewable energy (if applicable) | Not applicable |
| | Energy removed/replaced, amount or type of fuel | Fossil Fuel |
| | Estimated greenhouse gas emission reductions for each emission source sector | 3,443.92 $tCO_2$/year |
| | Compensated greenhouse gas emissions (carbon dioxide absorbed) | Not applicable |
| | Total and unit (per unit CO2e) costs | PLN 39,783,783.8 / EUR 8,840,840.84<br>11,551.8 PLN/tCO2e / 2567 EUR/$tCO_2$ e |

| **B-2.2: Outline of individual actions** | | |
|---|---|---|
| (Complete one sheet for each intervention/project) | | |
| Description of actions | Action name | Action B - 1<br>**Modernisation of municipal buildings** |
| | Type of action | Buildings, direct reduction |
| | Description of actions | Increasing the energy efficiency in existing city-owned residential and commercial buildings through deep thermal modernisation, optimising energy consumption by installing smart energy management systems and installing renewable energy sources (electricity and heat). |
| Reference to impact pathways | Impact sector | Buildings and heating |
| | System lever | Technology & infrastructure, governance & policy, finance & funding |

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| | Impact (with reference to module B-1.1) | Reduced energy consumption in existing buildings in the Praga-Południe and Ursynów districts. |
| Implementation | Units/persons responsible for the implementation | City of Warsaw, district offices. |
| | Scale of action and entities covered | Deep thermal modernisation and installing renewable energy sources is a measure dedicated to all buildings: commercial (office, retail, services), residential (multi-family and single-family), while the installation of smart energy management systems mainly concerns commercial buildings. |
| | Involved stakeholders | Municipal budget units, entrepreneurs cooperating in terms of PPP (public-private partnership), the ESCO formula, and other forms of public investment funding. |
| | Comments concerning implementation - resources needed, timetable and milestones | The action provides for direct investment in the city's stock of residential and commercial buildings (municipal buildings, schools, hospitals, offices, social housing, and warehouses). Implementing this action on a large scale depends on financial support schemes at national, EU and regional level and the availability of a sufficient number of qualified service providers in the market. |
| Receipts and costs | Generated renewable energy (if applicable) | Not applicable |
| | Energy removed/replaced, amount or type of fuel | Not applicable |
| | Estimated greenhouse gas emission reductions for each emission source sector | 23,257.31 tCO2e |
| | Compensated greenhouse gas emissions (carbon dioxide absorbed) | Not applicable |
| | Total and unit (per unit CO2e) costs | PLN 2,844,000,000 / EUR 632,000,000<br>122,284.10 PLN/tCO2e / 27,174.25 EUR/tCO2e |

| B-2.2: Outline of individual actions | | |
|---|---|---|
| (Complete one sheet for each intervention/project) | | |
| Description of actions | Action name | Action B-2<br>**Modernisation of private buildings** |
| | Type of action | Buildings, direct reduction |
| | Description of actions | Increasing energy efficiency in existing, privately owned residential and commercial buildings through deep thermal modernisation, optimising energy consumption by installing smart energy management systems and installing renewable energy sources (electricity and heat). |
| Reference to impact pathways | Impact sector | Buildings and heating |
| | System lever | Technology & infrastructure, governance & policy, finance & funding |
| | Impact (with reference to module B-1.1) | Reduced energy consumption in existing buildings in the Praga-Południe and Ursynów districts. |
| Implementation | Units/persons responsible for the implementation | City of Warsaw, district offices. |
| | Scale of action and entities covered | Deep thermal modernisation and installing renewable energy sources is a measure dedicated to all buildings: commercial (office, retail, services), residential (multi-family and single-family), while the installation of smart energy management systems mainly concerns commercial buildings. |
| | Involved stakeholders | Municipal budget units, housing associations, institutions, entrepreneurs, residents. |
| | Comments concerning implementation – resources needed, timetable and milestones | The measure provides for stimulating investments in modernising private, residential and commercial buildings (industrial, commercial, services, warehouses) belonging to housing cooperatives, enterprises and institutions not related to local government, private individuals, by creating a system of |

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| | | incentives as well as financial and material support for building owners. Implementing this action on a large scale depends on financial support systems at the national, EU, and regional level, in particular subsidy and loan programmes on preferential terms as well as support instruments for those affected by energy poverty, as well as the introduction of national legislation motivating building owners to undertake modernisation measures, e.g. implementing the European "*Energy Performance of Buildings Directive*" (*EPBD*). |
| Receipts and costs | Generated renewable energy (if applicable) | Not applicable |
| | Energy removed/replaced, amount or type of fuel | Not applicable |
| | Estimated greenhouse gas emission reductions for each emission source sector | 228,172 tCO2 |
| | Compensated greenhouse gas emissions (carbon dioxide absorbed) | Not applicable |
| | Total and unit (per unit CO2e) costs | PLN 42,088,000,000 / EUR 9,352,888,888<br>184,457.30 PLN/tCO2e / 40,990.52 EUR/tCO2e |

| **B-2.2: Outline of individual actions** | | |
|---|---|---|
| Description of actions | Action name | Action B-3<br>**New energy-efficient private, cooperative or non-municipal owned buildings** |
| | Type of action | Buildings, direct reduction |
| | Description of actions | a. Designing and constructing new, buildings not owned by the city (commercial and residential) in accordance with high requirements regarding, among other things, energy efficiency and the use of renewable energy. |

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| | | b. Reducing demand for electricity and heat by introducing cogeneration solutions in new utility buildings not owned by the city and using waste heat (waste heat from underground tunnels, server rooms, sewage and waste water, industrial processes, cooling processes). |
| Reference to impact pathways | Impact sector | Buildings and heating |
| | System lever | Technology & infrastructure, governance & policy, finance & funding |
| | Impact (with reference to module B-1.1) | Reduced energy consumption in newly constructed private, cooperative, or non-government owned buildings in the Praga-Południe and Ursynów districts. A greater share of renewable energy sources in the district energy balance. |
| Implementation | Units/persons responsible for the implementation | City of Warsaw, district offices. |
| | Scale of action and entities covered | The action applies to all buildings: commercial and residential, not owned by the city in the districts implementing the Climate City Contract.<br>Introducing of cogeneration solutions and using waste heat (from subways, server rooms, sewage and waste water, industrial processes, refrigeration processes) in new commercial buildings mainly concerns commercial buildings (industrial, office, service and storage buildings). |
| | Involved stakeholders | Municipal budgetary units, investors (entrepreneurs, institutions), residents, NGOs, scientific institutes and universities. |
| | Comments concerning implementation – resources needed, timetable and milestones | Reducing energy demand and using carbon-free energy sources through designing and constructing new, buildings not owned by the city to high energy efficiency standards lies at the very heart of the action. The city only has a direct impact on the energy standard of its own buildings. A prerequisite for successfully implementing high efficiency standards for buildings consists of legislative changes at national level, e.g. implementing the EU's |

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| | | "Energy Performance of Buildings Directive" (EPBD). |
| Receipts and costs | Generated renewable energy (if applicable) | Not applicable |
| | Energy removed/replaced, amount or type of fuel | Not applicable |
| | Estimated greenhouse gas emission reductions for each emission source sector | 10,023 $tCO_2$ |
| | Compensated greenhouse gas emissions (carbon dioxide absorbed) | Not applicable |
| | Total and unit (per unit CO2e) costs | PLN 1,554,836,236.7 / EUR 345,519,163.71<br>155,126.8 PLN/tCO2e / 34,472.6 EUR/$tCO_2$ e |

| **B-2.2: Outline of individual actions** | | |
|---|---|---|
| Description of actions | Action name | Action B-4<br>**New energy-efficient municipal buildings** |
| | Type of action | Buildings, direct reduction |
| | Description of actions | a. Designing and constructing new urban commercial and residential buildings in accordance with the requirements of the Warsaw Green Building Standard, which includes high requirements for, among other things, energy efficiency, and energy use.<br>b. Reducing the demand for electricity and heat by introducing cogeneration solutions and using waste heat (waste heat from metro tunnels, server rooms, sewage and waste water, industrial processes, cooling processes) in new utility buildings owned by the city. |
| Reference to impact pathways | Impact sector | Buildings and heating |

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| | System lever | Technology & infrastructure, governance & policy, finance & funding |
| | Impact (with reference to module B-1.1) | Reducing energy consumption in newly constructed municipal buildings in the Praga-Południe and Ursynów districts. A greater share of renewable energy sources in the district energy balance. |
| Implementation | Units/persons responsible for the implementation | City of Warsaw, district offices, municipal entities and companies, |
| | Scale of action and entities covered | The building energy efficiency standards contained in the Warsaw Green Building Standard apply to all municipal, newly constructed buildings (commercial and residential). For municipal buildings, the standard will be a mandatory solution. Introducing cogeneration solutions and using waste heat (subways, server rooms, sewage and waste water, industrial processes, cooling processes) mainly concerns municipal commercial buildings. |
| | Involved stakeholders | Municipal budgetary units, entrepreneurs (cooperating in terms of the PPPs, the ESCO formula, and other forms of public investment funding), institutions, residents, NGOs, scientific institutes, and universities. |
| | Comments concerning implementation - resources needed, timetable and milestones | Reducing the energy demand and using zero-carbon energy sources through directly investing in designing and constructing new municipal buildings according to high energy efficiency standards, which will be introduced as early as 2024 as part of the Warsaw Green Building Standard, lies at the very heart of the action. Due to the difficulty in estimating the number of new municipal buildings (a negligible number of municipal buildings completed over the last few years), an estimated GHG reduction for a single municipal building is indicated. |
| Receipts and costs | Generated renewable energy (if applicable) | Not applicable |
| | Energy removed/replaced, amount or type of fuel | Not applicable |

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| | Estimated greenhouse gas emission reductions for each emission source sector | 334.1 tCO2e/year |
| | Compensated greenhouse gas emissions (carbon dioxide absorbed) | Not applicable |
| | Total and unit (per unit CO2e) costs | PLN 51,827,874.56 / EUR 11,517,305.46<br>155,126.8 PLN/tCO2e / 34,472.6 EUR/tCO2 |

| **B-2.2: Outline of individual actions** | | |
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| Outline of actions | Action name | Action T-1<br>**Developing the pedestrian and bicycle infrastructure** |
| | Type of action | Infrastructure, education, support measures |
| | Action description | Examples of actions to be implemented:<br>a) constructing new bicycle routes, together with associated infrastructure and linking them into coherent networks. Including the expansion of the Veturilo urban bicycle network by municipal entities and encouraging the private sector to set up so-called sponsor stations,<br>b) developing the "Szkolne Ulice" and "Droga na Szóstkę" programmes - reducing car traffic and enabling safe zero-carbon pedestrian traffic near schools,<br>c) promoting the use of bicycles for commuting to work and school and as freight transport - educational and information campaign on urban media,<br>d) introducing policies/strategies for developing individual cycling transport. |
| Reference to the impact pathways | Scope of activity | Transport |
| | System lever | Technology and infrastructure, Education |
| | Result (according to Module B-1.1) | Increased accessibility to bicycle transport and cycling range in the city and opportunities for comfortable walking. |
| Implementation | Authorities/persons responsible for implementation | District Offices and municipal entities such as the Public Roads Authority in Warsaw, |

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| | | Infrastructure Department, Mobility Policy & Public Transport Department, the private sector |
| | Scale of action and addressed entities | City-wide and systemic actions in two districts |
| | Involved stakeholders | District authorities, city companies, residents, national and regional authorities, private sector |
| | Comments on implementation - consider mentioning resources, timelines, milestones | Extending the Veturilo urban bicycle network and including remaining towns and cities of the Warsaw metropolitan area in the system.<br>Stations can also be funded by the private sector.<br>Developing and improving the safety of infrastructure for cyclists and pedestrians. Creating high speed cycle routes with a limited number of traffic lights and stops to cover longer distances in the city. "Zielona Fala" for cyclists and more visible (safe) cycling infrastructure - including technical points and urban chargers for RES-powered electric bikes. Separating pedestrian traffic with a visible spatial barrier, e.g. a strip of shrubbery from parallel cycling traffic.<br>A cycling action in May for children and young people combined with a gamification action for adults from the business sector and the City of Warsaw as well as municipal units.<br>Introducing a policy/strategy for developing individual cycling transport would be an action aimed at identifying a vision for cycling until 2030 and measures which will make implementing it possible. |
| Impact and cost | Renewable energy generated (if applicable) | Not applicable |
| | Energy, volume or type of fuel removed/replaced | Fossil Fuel |
| | Estimated greenhouse gas emission reductions (total) by source sector | 2,467.8 t $CO_2$ e |
| | Compensated greenhouse gas emissions (natural or technological sinks) | Not applicable |
| | Total costs and costs in CO2e | PLN 1,500,000 / EUR 333,333 - 1 km of a bicycle path |

| B-2.2: Outline of individual actions | | |
|---|---|---|
| Outline of actions | Action name | Action T-2<br>**Development of public transport** |
| | Type of action | Infrastructure measures |
| | Action description | Examples of actions to be implemented:<br>a) increasing accessibility to public transport and counteracting transport exclusion, especially for the elderly, children, and persons with disabilities,<br>b) expansion of the public transport network (zero-emission buses, metro, trams). Including purchasing modern, energy-efficient low-floor trams, replacing the bus fleet with electric/hydrogen vehicles,<br>c) supporting the use of public transport, improving passenger comfort through implementation/development in two districts,<br>d) smart traffic management systems as well as smart and inclusive (read out loud, illuminated timetables) passenger information systems at bus stops,<br>e) designating bus lanes. |
| Reference to the impact pathways | Scope of activity | Transport |
| | System lever | Technology and infrastructure, governance and policy, science, finance and funding |
| | Result (according to Module B-1.1) | Reduced demand for motorised passenger transport and a shift towards public and non-motorised transport |
| Implementation | Authorities/persons responsible for implementation | Relevant Offices of the City of Warsaw for Infrastructure and Public Transport |
| | Scale of action and addressed entities | Activities carried out by municipal entities |
| | Involved stakeholders | District authorities, municipal companies, residents, national and regional authorities |
| | Comments on implementation - consider mentioning resources, timelines, milestones | New tram routes in the area of Praga-Południe financed by Tramwaje Warszawskie will be constructed by 2030. Reconstructing the existing ones involves using vegetated track where possible. Necessary adaptation of bus stops and supporting infrastructure to the needs |

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| | | of the elderly, children, and persons with disabilities.<br>Buses - there will be 202 electric buses in the citywide fleet by 2025, and the need for further fleet replacement has been identified, especially for the Praga-Południe and Ursynów districts. A hydrogen bus is also currently being tested.<br>Construction of the 3rd metro line in the Praga-Południe district is scheduled to begin in 2028. |
| Impact and cost | Renewable energy generated (if applicable) | - |
| | Energy, volume or type of fuel removed/replaced | Fossil Fuel |
| | Estimated greenhouse gas emission reductions (total) by source sector | 144,555 $tCO_2$ e |
| | Compensated greenhouse gas emissions (natural or technological sinks) | Not applicable |
| | Total costs and costs in $CO_2$ e | Purchasing 234 new electric buses:<br>PLN 739 440 000/ EUR 164 320 000<br>Costs of building charging infrastructure on 48 loops (all loops in two districts):<br>PLN 28 800 000 / EUR 6 400 000<br>Pilot programme of purchasing 10 hydrogen-powered buses:<br>PLN 49,100,000 / EUR 10,800,000<br>The cost of using electricity to power an electric bus:<br>PLN 150,800,000 / EUR 33,500,000<br>Maintenance costs for electric vehicle charging points:<br>PLN 11,700,000 / EUR 2,600,000<br>Estimated cost:<br>PLN 979 840 000 / EUR 217 742 222<br>6 778 PLN/tCO2e / 1 506 EUR/$tCO_2$ e |

| **B-2.2: Outline of individual actions** | | |
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| Outline of actions | Action name | Action T-3<br>**Decarbonisation of car transport and construction of electric vehicle charging stations** |

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| | Type of action | Infrastructure, education, support measures |
| | Action description | Examples of actions to be implemented:<br>a) enabling greater use of zero-emission transport in the city<br>b) developing charging infrastructure in the two districts of Praga-Południe and Ursynów, including access to at least one charging station in each car park. Incentives for installing chargers on private land for businesses and individuals (possible with energy storage),<br>c) parking infrastructure, the so-called Kiss+Ride in favour of using carpooling and carsharing,<br>d) campaigns, initiatives, and incentives to promote carpooling and carsharing,<br>implementing smart city solutions - e.g. MobiWawa - an app module for carpooling and carsharing |
| Reference to the impact pathways | Scope of activity | **Transport** |
| | System lever | Technology and infrastructure, governance and policy, science, finance and funding |
| | Result (according to Module B-1.1) | Increased number of shared rides. Reducing car traffic. Electrification of cars + motorbikes, etc. |
| Implementation | Authorities/persons responsible for implementation | District Offices and municipal entities such as the Public Roads Authority in Warsaw, the Public Transport Authority, the Infrastructure Department, the Mobility Policy & Public Transport Department, the private sector |
| | Scale of action and addressed entities | Activities carried out by municipal entities |
| | Involved stakeholders | District offices, city companies, residents, national, and regional authorities, heat and power generation companies, charging station operators and alternative fuel development organisations, neighbourhood fleet companies, charging station operators and alternative fuel development organisations, companies with car fleets in district areas |
| | Comments on implementation - consider mentioning resources, timelines, milestones | Increasing the number of electric car chargers co-powered by renewable energy sources - according to the "Plan for the construction of publicly accessible charging stations for electric vehicles in the area of Warsaw". A total of 44 |

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| | | charging points are planned for the Praga-Południe district and 50 for Ursynów.<br>Introducing incentives for residents, showing them the benefits of commuting together or taking their children to school. |
| Impact and cost | Renewable energy generated (if applicable) | yes |
| | Energy, volume or type of fuel removed/replaced | Fossil Fuel |
| | Estimated greenhouse gas emission reductions (total) by source sector | 100,466.29 $tCO_2$ e |
| | Compensated greenhouse gas emissions (natural or technological sinks) | Not applicable |
| | Total costs and costs in $CO_2$ e | PLN 8,516,969.70 / EUR 1,892,659 EUR -> 94 charging points<br>84.8 PLN/tCO2e / 18 EUR/$tCO_2$ e |

| **B-2.2: Outline of individual actions** | | |
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| Reference to the impact pathways | Action name | Action G-1<br>**Development of the blue-green infrastructure network** |
| | Type of action | Infrastructural, strategic measures |
| | Action description | Examples of actions to be implemented:<br>a) developing and implementing a comprehensive concept for greening the city as well as updating and implementing a comprehensive concept for rainwater and snowmelt management (2020) (a requirement announced in the new regulations of the Ministry of Climate and Environment) within the framework of the update of the Municipal Adaptation Plan planned for 2024-2026 (Climate Change Adaptation Strategy of Warsaw up to 2030 with a perspective up to 2050, from 2019). It will provide a comprehensive approach to combining green space development and stormwater management, which will have a significant impact on building the city's resilience to hydrological and thermal hazards, increasing continuity and creating a coherent blue-green infrastructure (BZI) system. It will include a BZI inventory, a diagnosis of the state of blue-green |

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| | | infrastructure, an assessment and monitoring system for ecosystem services,<br>b) inclusion in preparing and implementing the support offered by the tools and consortium of the Climate Change Adaptation Mission, to which Warsaw belongs from 2023 according to the Mission charter,<br>c) smart solutions for urban greenery inventory and ecosystem service assessment - developing a monitoring system based on a tree crown map and ecosystem services,<br>d) introducing provisions in local spatial development plans (MPZP) to protect and develop BZI,<br>e) In the two districts of Praga-Południe and Ursynów, it is planned to intensify work concerning completing the blue-green infrastructure network, including by<br>- removing concrete mainly from courtyards and streets<br>- plantings to increase the resilience of the flora as well as improve biodiversity and the quality of PBC and the level of ecosystem services<br>- maintaining and protecting the city's aeration corridors. |
| Reference to the impact pathways | Scope of activity | Blue-green infrastructure and nature-based solutions (NBS) |
| | System lever | Technology and infrastructure, governance and policy, science, finance and funding, education and communication |
| | Result (according to Module B-1.1) | Ensuring close access to green areas for 90% of the residents of the Praga-Południe and Ursynów districts |
| Implementation | Authorities/persons responsible for implementation | City Hall, District Offices, and municipal entities |
| | Scale of action and addressed entities | Activities in the two districts in connection with the urban and metropolitan system |
| | Involved stakeholders | District authorities, city companies, residents, national and regional authorities, private sector |
| | Comments on implementation - consider mentioning resources, timelines, milestones | Green areas account for nearly 47% of Warsaw's area, which offers great potential for maintaining and developing a coherent BZI system in the city. They perform important environmental functions and provide a range of sustaining, regulatory, cultural and provisioning services to residents, determining the quality of |

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| | | life in the city and its adaptation to climate change. The districts of Praga-Południe and Ursynów include deficiencies in the continuity of greenery, which should be remedied by the various measures taken, just as their quality should be systematically improved.<br><br>Implementing a comprehensive system for managing the city's blue-green infrastructure is key to keeping it in good condition and providing high levels of ecosystem services, building the city's resilience to climate risks. It depends on land ownership and management structure, which is dispersed in the city. In 2016, the Warsaw Greenery Board (a budgetary unit of Warsaw established by Resolution No. XXXIII/816/2016 of the City Council of 25 August 2016), which cares for and finances the care and development of green spaces in the city, including city parks, gardens, squares, greens. managing green spaces and some surface water constitutes the responsibility of a number of municipal entities both central at the city level and territorial in the districts. Implementing uniform management and standards of caring for and developing blue-green infrastructure areas and applying them by all responsible parties in the city will be a key task to ensure the proper functioning of the BZI system. |
| Impact and cost | Renewable energy generated (if applicable) | Not applicable |
| | Energy, volume or type of fuel removed/replaced | Not applicable |
| | Estimated greenhouse gas emission reductions (total) by source sector | Not applicable |
| | Compensated greenhouse gas emissions (natural or technological sinks) | No data |
| | Total costs and costs in CO2e | No data |

| **B-2.2: Outline of individual actions** | | |
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| Reference to the impact pathways | Action name | Action G-2<br>**Increasing the area of green spaces** |
| | Type of action | Infrastructural, strategic measures |
| | Action description | Examples of actions to be implemented: |

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| | | a) maintaining in good condition the existing and creating new green areas in the Praga-Południe and Ursynów districts, in particular by removing concrete, transforming degraded areas around buildings into green areas, replacing impervious surfaces with high quality biological surfaces (medium and high greenery), using green roofs, walls, tracks, etc,<br>b) actions focused on: maintaining existing and developing new: urban forests, urban parks and squares, greening backyards, greening in the immediate surroundings of residential buildings including green walls and roofs, areas near educational institutions as well as cultural, sports, and recreation centres, greening streets, including road lanes, bus stops, and tracks,<br>c) supporting the development of private green spaces in accordance with good practice and urban standards - the city's concrete removal grant system, the Green Fund of the Warsaw Greenery Board, cooperation in terms of the framework of the Partnership for Climate,<br>d) smart solutions for urban greenery inventories and ecosystem service assessments,<br>e) applying the principles of the city and the 15-minute community - access to local ecosystem services, developing accessible green spaces close to where people live. |
| Reference to the impact pathways | Scope of activity | Action G-3<br>**Blue-green infrastructure and nature-based solutions (NBS)** |
| | System lever | Technology and infrastructure, governance and policy, science, finance and funding, education and communication |
| | Result (according to Module B-1.1) | Developing blue-green infrastructure in the city<br>Increasing the quality of life of residents, the level of health, as well as the tourist attractiveness of Warsaw and the surrounding area by expanding and diversifying the urban ecosystem and creating friendly places for recreation and relaxation. |
| Implementation | Authorities/persons responsible for implementation | City Hall, District Offices, and municipal entities |
| | Scale of action and addressed entities | Activities in the two districts in connection with the urban and metropolitan system |

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|---|---|---|
| | Involved stakeholders | District authorities, municipal bodies and companies, residents, national and regional authorities, private sector |
| | Comments on implementation - consider mentioning resources, timelines, milestones | As many as 66% of Warsaw's residents are exposed to thermal hazards, 29% to hydrological hazards, and 19% to both types of hazards combined. The occurrence of risks resulting from the effects of climate change depends largely on how the land is developed.<br>Therefore, the city strives to ensure that appropriate provisions are made in strategic and planning documents, including the Local Spatial Development Plan, has and develops standards of care for greenery, standards for the development of biodiversity, promotes adaptation measures among residents and the private sector, among others, by implementing and developing these initiatives. It is important to maintain them, to ensure funding in the long term min. 5 years. We have adopted the planting of 250,285 trees across the whole city by 2030, or approx. 20000 trees per year. |
| Impact and cost | Renewable energy generated (if applicable) | Not applicable |
| | Energy, volume or type of fuel removed/replaced | Not applicable |
| | Estimated greenhouse gas emission reductions (total) by source sector | Not applicable |
| | Compensated greenhouse gas emissions (natural or technological sinks) | 175,200 tCO2e |
| | Total costs and costs in CO2e | Estimated costs: approx. PLN 130,217,750 / EUR 28,937,277<br>743 PLN/tCO2e / 165 EUR |

| **B-2.2: Outline of individual actions** | | |
|---|---|---|
| Reference to the impact pathways | Action name | Action G-4<br>**Implementation of sustainable rainwater management systems** |
| | Type of action | Infrastructure, strategic, information, and education measures |
| | Action description | Examples of actions to be implemented: |

| | | |
|---|---|---|
| | | a) using rainwater and snowmelt on site and to counteract urban flooding and waterlogging,<br>b) implementing measures and monitoring rainwater and snowmelt management concepts within the city (followed by the metropolitan area),<br>c) smart solutions for urban green inventory and ecosystem service assessment - urban monitoring of blue-green infrastructure,<br>d) greening streets, road lanes, bus stops, and tracks,<br>e) renaturalisation of urban rivers,<br>f) creating reservoirs,<br>g) creating rain gardens, retention basins,<br>h) maintaining and expanding the network of permanent and episodic retention reservoirs and the stormwater drainage network,<br>i) developing infiltration into the ground in urban areas and supporting it on private land,<br>j) information and education activities, e.g. concerning the basis of the Warsaw Climate Change Adaptation Guidebook, workshops and meetings for residents, within the framework of the Climate Partnership and the activities of the Climate Change Adaptation Mission,<br>k) subsidies for removing concrete and retention for the private sector, especially for residents,<br>l) promoting so-called "green projects" in terms of the framework of the Participatory budgeting related to retention, removing concrete, and greening,<br>m) implementing the Warsaw Green Building Standard - support in implementing retention tasks by municipal entities and then the private sector. |
| Reference to the impact pathways | Scope of activity | Blue-green infrastructure and nature-based solutions (NBS) |
| | System lever | Technology and infrastructure, governance and policy, science, finance and funding, education and communication |
| | Result (according to Module B-1.1) | Developing blue-green infrastructure in the city<br>Increasing the quality of life of residents, the level of health, as well as the tourist attractiveness of Warsaw and the surrounding |

| | | |
|---|---|---|
| | | area by expanding and diversifying the urban ecosystem and creating friendly places for recreation and relaxation. |
| Implementation | Authorities/persons responsible for implementation | City Hall, District Offices, and municipal entities |
| | Scale of action and addressed entities | Activities in the two districts in connection with the urban and metropolitan system |
| | Involved stakeholders | District authorities, city companies, residents, national and regional authorities, private sector |
| | Comments on implementation - consider mentioning resources, timelines, milestones | Actions should focus on implementing the concept of rainwater and snowmelt management by all urban units, introducing a uniform reporting system for the entire city (and in time for the metropolis) and building a system of incentives for the private sector, including financial support for private investments, educational and informational activities for individuals and entrepreneurs / other private entities related to environmental and economic benefits concerning implementing solutions for appropriate adaptive water management, in particular surface sealing.<br><br>It will also be important to co-operate with the government level in updating the regulations related to the lack of drainage from allotment sites.<br><br>Municipal units secure drinking water sources and these are subject to constant monitoring.<br><br>With regard to the hydrographic system of Warsaw, comprehensive measures aimed at its protection, restoration, and renaturalisation are necessary.<br><br>The city is developing a city information collection system, the City Information Bank, which aims to provide a comprehensive, standardised and accessible collection of qualitative data concerning, among other things, climate protection and the environment. |
| Impact and cost | Renewable energy generated (if applicable) | No data |
| | Energy, volume or type of fuel removed/replaced | No data |
| | Estimated greenhouse gas emission reductions (total) by source sector | No data |

| | | |
|---|---|---|
| | Compensated greenhouse gas emissions (natural or technological sinks) | No data |
| | Total costs and costs in CO2e | 1 rainwater retention tank (design documentation, purchase of tank, installation of pumps and modules) PLN 80,000/EUR 17,777<br>1 rain garden (design documentation, implementation, maintenance - price depends on garden size and number of individual elements) PLN 200,000 / EUR 44,444 |

| **B-2.2: Outline of individual activities** | | |
|---|---|---|
| Reference to the impact pathways | Action name | Action G-5<br>**Protecting valuable habitats and ensuring the coherence, continuity, and development of blue-green infrastructure** |
| | Type of action | Infrastructure, strategic, information, and education measures |
| | Action description | Protecting valuable green spaces and other valuable natural areas against urbanisation pressures by introducing a municipal conservation programme, appropriate provisions in strategic and planning documents at central level for the entire city and at a local level for individual Municipal Spatial Development Plans.<br>Example actions:<br>a) developing a spatial database concerning the city, especially smart solutions for the inventory of greenery in the city and the assessment of ecosystem services, biodiversity (inventory of environmentally valuable areas and their condition),<br>b) municipal land buy-back programme,<br>c) introducing standards to support biodiversity,<br>d) maintaining and developing the Green Rings of Warsaw - an element of the BZI system - ensuring its continuity,<br>e) establishing pocket parks,<br>f) engaging residents and the private sector in monitoring and protecting nature-valuable areas - citizen science activities - provision of tools (apps), family allotments as biodiversity sites, e.g. tackling light pollution in these areas. |

| | | |
|---|---|---|
| Reference to the impact pathways | Scope of activity | Blue-green infrastructure and nature-based solutions (NBS) |
| | System lever | Technology and infrastructure, governance and policy, science, finance and funding, education and communication |
| | Result (according to Module B-1.1) | Developing blue-green infrastructure in the city<br>Increasing the quality of life of residents, the level of health, as well as the tourist attractiveness of Warsaw and the surrounding area by expanding and diversifying the urban ecosystem and creating friendly places for recreation and relaxation. |
| Implementation | Authorities/persons responsible for implementation | City Hall, District Offices, and municipal entities |
| | Scale of action and addressed entities | Activities in the two districts in connection with the urban and metropolitan system |
| | Involved stakeholders | District authorities, city companies, residents, national and regional authorities, private sector |
| | Comments on implementation - consider mentioning resources, timelines, milestones | Providing funds in the city budget for land purchase constitutes one of the most important elements in implementing the protection of environmentally valuable areas and minimising urbanisation pressure on them together with appropriate protective provisions in the city's strategic and planning documents, such as the Climate Change Adaptation Strategy or the Local Spatial Development Plan.<br>An important step in facilitating achieving this goal would be developing protective provisions at the level of national legislation with the government. |
| Impact and cost | Renewable energy generated (if applicable) | No data |
| | Energy, volume or type of fuel removed/replaced | No data |
| | Estimated greenhouse gas emission reductions (total) by source sector | No data |
| | Compensated greenhouse gas emissions (natural or technological sinks) | No data |
| | Total costs and costs in CO2e | Maintaining biologically active areas: PLN 7.40/m2 / EUR 1.60/m2 |

| | | |
|---|---|---|
| | | Creating a pocket park:<br>PLN 50,000 – 250,000 / EUR 33,000 – 55,000 |

| **B-2.2: Outline of individual actions** | | |
|---|---|---|
| Description of actions | Action name | Action W-1<br>**Preventing and reducing waste, in line with the idea of a circular economy** |
| | Type of action | Infrastructure, education, support measures |
| | Description of actions | Examples of actions to be implemented:<br>a. creating exchange points (e.g. "Saska Kępa" sharing initiative),<br>b. organising so-called "Libraries of things",<br>c. organising an event involving the exchange of goods such as children's accessories, games, clothes, sports equipment, etc.<br>d. organising so-called "Repair cafés" available to residents<br>e. organising so-called "book cabinets" in public places for exchanging books<br>f. promoting the "WawaShare" initiative (urban database of sharing economy sites/projects) among residents<br>g. setting up additional containers for separate waste collection in public areas e.g. parks, squares. |
| Reference to impact pathways | Impact sector | Waste |
| | System lever | Technology and infrastructure, governance and policy, finance and funding |
| | Impact (with reference to module B-1.1) | Greater emphasis on reusing materials to decarbonise waste processing and the end product. |
| Implementation | Units/persons responsible for the implementation | City of Warsaw - Waste Management Department, District Offices and Municipal Units |
| | Scale of action and entities covered | Covers the entire project area. Activities carried out in parallel by stakeholders - municipal entities, private companies responsible for waste disposal |

| | | |
|---|---|---|
| | Involved stakeholders | City of Warsaw, District offices, city companies, local businesses, residents, businesses, private companies, NGOs. |
| | Comments concerning implementation - resources needed, timetable and milestones | These activities are aimed at creating a so-called "second circuit of things" that can be reused. There needs to be an entire system of incentives and benefits for such units or residents who want to take advantage of the closed loop. |
| Receipts and costs | Generated renewable energy (if applicable) | Not applicable |
| | Energy removed/replaced, amount or type of fuel | No data |
| | Estimated greenhouse gas emission reductions for each emission source sector | No data |
| | Compensated greenhouse gas emissions (carbon dioxide absorbed) | Not applicable |
| | Total and unit (per unit $CO_2e$) costs | PLN 4571 / EUR 1015 per 1 recycling bin |

| **B-2.2: Outline of individual actions** | | |
|---|---|---|
| Description of actions | Action name | Action W-2<br>**Improving the quality of selective collection at source and increasing the amount of selectively collected waste** |
| | Type of action | Infrastructure, education, support measures |
| | Description of actions | Examples of actions to be implemented:<br>a. establishing Selective collection Points for municipal waste,<br>b. information and education campaigns for residents concerning the operation of the Municipal Separate Waste Collection Centres,<br>c. support for entrepreneurs in terms of selective waste collection, e.g. developing information materials on the principles of municipal waste management for entrepreneurs. |
| Reference to impact pathways | Impact sector | Waste |
| | System lever | Technology and infrastructure, governance and policy, finance and funding |

| | | |
|---|---|---|
| | Impact (with reference to module B-1.1) | Greater emphasis on reusing materials to decarbonise waste processing and the end product. |
| Implementation | Units/persons responsible for the implementation | City of Warsaw - Waste Management Department, District Offices and Municipal Units |
| | Scale of action and entities covered | Covers the entire project area. Activities carried out in parallel by stakeholders - municipal entities, private companies responsible for waste disposal and treatment |
| | Involved stakeholders | City of Warsaw, District offices, city companies, local businesses, residents, businesses, private companies, NGOs. |
| | Comments concerning implementation - resources needed, timetable and milestones | Adapting waste management infrastructure to current and future legislation. Further development of the selective waste collection process requires measures improving the existing waste collection process, including additional education of residents or implementing new waste sorting technologies. Some of the necessary actions are conditioned by legislation of a national nature. |
| Receipts and costs | Generated renewable energy (if applicable) | Not applicable |
| | Energy removed/replaced, amount or type of fuel | Not applicable |
| | Estimated greenhouse gas emission reductions for each emission source sector | No data |
| | Compensated greenhouse gas emissions (carbon dioxide absorbed) | Not applicable |
| | Total and unit (per unit $CO_2e$) costs | Constructing 1 PSZOK (Selective Waste Collection Point) PLN 1,500,000 / EUR 267,000<br>(Pre-investment costs+CAPEX+EUR) PLN 16,710,000 / EUR 3,569,500 |

| **B-2.2: Outline of individual actions** | | |
|---|---|---|
| Description of actions | Action name | Action W-3<br>**Investments in solutions allowing achieving recovery and recycling levels** |
| | Type of action | Infrastructure, education, support measures |

| | | |
|---|---|---|
| | Description of actions | Examples of actions to be implemented:<br>a) constructing local waste sorting facilities. |
| Reference to impact pathways | Impact sector | Waste |
| | System lever | Technology and infrastructure, governance and policy, finance and funding |
| | Impact (with reference to module B-1.1) | Greater emphasis on reusing materials to decarbonise waste processing and the end product. |
| Implementation | Units/persons responsible for the implementation | City of Warsaw - Waste Management Department, District Offices and Municipal Units |
| | Scale of action and entities covered | Covers the entire project area. Activities carried out in parallel by stakeholders - municipal entities, private companies responsible for waste disposal and treatment |
| | Involved stakeholders | City of Warsaw, District offices, city companies, local businesses, residents, businesses, private companies, NGOs. |
| | Comments concerning implementation - resources needed, timetable and milestones | |
| Receipts and costs | Generated renewable energy (if applicable) | No data |
| | Energy removed/replaced, amount or type of fuel | Not applicable |
| | Estimated greenhouse gas emission reductions for each emission source sector | No data |
| | Compensated greenhouse gas emissions (carbon dioxide absorbed) | No data |
| | Total and unit (per unit $CO_2e$) costs | No data |

| **B-2.2: Outline of individual actions** | | |
|---|---|---|
| Description of actions | Action name | Action W-4<br>**Developing municipal biogas plants** |
| | Type of action | Infrastructure measures |
| | Description of actions | Examples of actions to be implemented: |

| | | |
|---|---|---|
| | | a. constructing following urban biogas plants to produce biogas from bio-waste, including green waste,<br>b. using the produced biogas to produce heat and electricity in cogeneration facilities,<br>c. using the produced biogas to produce CNG as a renewable fuel for municipal vehicles. |
| Reference to impact pathways | Impact sector | Waste |
| | System lever | Technology and infrastructure, governance and policy, finance and funding |
| | Impact (with reference to module B-1.1) | Greater emphasis on reusing materials to decarbonise waste processing and the end product. |
| Implementation | Units/persons responsible for the implementation | City of Warsaw - Waste Management Department, district offices and municipal units, Miejskie Przedsiębiorstwo Oczyszczania sp. z o.o. |
| | Scale of action and entities covered | Covers the entire project area. Activities carried out in parallel by stakeholders - municipal entities, private companies responsible for waste disposal and treatment |
| | Involved stakeholders | City of Warsaw, District offices, city companies, local businesses, residents, businesses, private companies, NGOs. |
| | Comments concerning implementation - resources needed, timetable and milestones | The city operates a biogas plant on the grounds of MPWiK, which supplies electricity and heat to the "Czajka" plant. It is necessary to construct following biogas plants for private institutions and connected them to the existing electricity and district heating networks. |
| Receipts and costs | Generated renewable energy (if applicable) | Approx. 1,502 MW/year |
| | Energy removed/replaced, amount or type of fuel | No data |
| | Estimated greenhouse gas emission reductions for each emission source sector | 5,600 tCO2/year |
| | Compensated greenhouse gas emissions (carbon dioxide absorbed) | No data |
| | Total and unit (per unit $CO_2e$) costs | PLN 44,122,500 / EUR 9,805,000<br>7879 PLN/tCO2e / 1750 EUR /tCO2e |

**Dialogue between the city of Warsaw and PGNiG Termika S.A.**

Warsaw's central district heating network is mainly supplied by several sources owned by PGNiG Termika S.A., which developed a Climate Neutrality Plan in June 2024. System heat generation activities are a very important element of the city's energy transition and have been recognized as one of the supporting activities for the Buildings and Heat sector (p. 114). As part of the dialogue on including stakeholders from all sectors in the joint climate effort, PGNiG Termika S.A. has expressed its willingness to cooperate with the City of Warsaw. PGNiG Termika S.A.'s actions, such as using waste and renewable heat to produce system heat, maintaining the status of an efficient district heating system, generating low- and zero-emission electricity locally in cogeneration to meet the needs of the Warsaw agglomeration in order to counteract the import of energy from outside, or increasing the efficiency of heat production by building a flue gas heat recovery facility, will positively contribute to building a more resilient, equitable and sustainable future for our community and our city.

## B-2.3: Summary of residual emissions strategy

To bridge the potential gap between emission reductions of up to 80% and net climate neutrality, we envisage the following measures:

- increasing the efficiency of natural CO2 sequestration (through selecting vegetation and increasing areas of blue-green infrastructure) within the mission districts and outside the boundaries of these districts, but within the administrative boundaries of the city,
- geological sequestration (its use will depend on the emergence of new, more efficient and cheaper technologies),
- Purchasing carbon credits - certificates confirming the reduction of greenhouse gases by investing in an environmental project (the issue of purchasing carbon credits must, however, be analysed by the municipal legal and accounting services for their compliance with the regulations governing the operation of the local authority).

A concrete action plan will be presented in one of the following iterations of the document.

The following constitutes a description of the portfolio of support measures that are necessary in terms of facilitating the implementation of reduction measures and taking care of important social issues. The actions are address to previously identified system barriers and constraints.

## B-2.4: Description of the portfolio of support activities

| Barrier/restriction | Portfolio description | |
|---|---|---|
| | Impact sector | List of actions to be taken |
| Constraints for developing blue-green infrastructure (BZI) | Green infrastructure and nature-based solutions | • actions through self-government organisations and the National Cooperation Platform to promote legislative changes at national level to enable self-governments to |

| | | |
|---|---|---|
| | | better protect valuable land from urbanisation pressures and to introduce quality standards for investors regarding the development of the investment environment,<br>• implementing the Warsaw Green Building Standard currently under development in Warsaw for new and retrofitted municipal buildings,<br>• introducing uniform standards for developing and maintaining green spaces for all those responsible for maintaining urban green spaces,<br>• selecting plant species with increased resistance to heat, drought, and other hazards. |
| Lack of a developed network of local and district centres | Transport | • commissioning a feasibility study and a development plan for the mission districts in terms of the objectives of the 15-minute city concept. |
| Dependence on the National Grid (KSE) and the national energy mix. | Energy system<br>Buildings and heating | • activities initiating change, through local government organisations and the National Cooperation Platform, regarding decarbonisation and modernisation of the national energy system,<br>• creating a local strategic partnership between the city and the main energy producers and suppliers in the city to agree on joint decarbonisation measures |
| Limited direct impact on the city's greenhouse gas emissions. | Fair transition and social participation | • involving the widest possible range of urban stakeholders in climate neutrality efforts,<br>• launching (at national and EU level), a broad, attractive programme of incentives (subsidies, discounts) for residents, entrepreneurs and other urban actors. |
| High costs and unknown scale of energy efficiency needs for buildings. | Buildings and heating<br>Fair transition and social participation | • completing building data in the Integrated Low Emission Reduction System (ZONE),<br>• carrying out a thermal imaging survey of buildings in the mission districts,<br>• activities aimed at launching (at national and EU level) systemic financial support programmes through local government organisations and the National Co-operation Platform. |
| Difficulties in using data. | Buildings and heating<br>Fair transition and social participation<br>Green infrastructure and nature-based solutions<br>Transport<br>Waste management and GOZ | • developing and implementing a tool for data integration and analysis at city level,<br>• agreements with suppliers and developing pathways for easy access to data,<br>• efforts to integrate and complement national databases through local government organisations and the National Cooperation Platform. |
| Problems with rainwater use. | Green infrastructure and nature-based solutions | • implementing the Warsaw Green Building Standard for new and modernised municipal buildings,<br>• work, through local government organisations and the National Cooperation Platform, to implement legislation at national level obliging investors to take advantage of |

| | | |
|---|---|---|
| | | solutions to ensure the retention and management of rainwater or snowmelt on the project site,<br>• intensifying efforts to unseal city-owned impervious surfaces in the districts covered by the Climate City Contract,<br>• intensification of educational activities, using the "Warsaw Climate Change Adaptation Handbook" addressed to property owners, cooperatives, housing communities in the districts covered by the Climate City Contract. |
| System barriers to RES development. | Energy system<br>Buildings and heating<br>Fair transition and social participation | • actions, through local government organisations and the National Cooperation Platform, for legislative change at national level,<br>• actions, through local government organisations and the National Cooperation Platform, for creating, at national level, stable legislation and a long-term strategy for developing renewable energy sources |
| Financial barriers. | Buildings and heating<br>Energy system<br>Fair transition and social participation<br>Green infrastructure and nature-based solutions<br>Transport<br>Waste management and GOZ<br>Fair transition and social participation | • actions, through local government organisations and the National Cooperation Platform, to facilitate access to national and EU funding programmes,<br>• actions in favour of increasing the level of private capital involvement in public investment in the city through the use of available forms of cooperation, creating dedicated funds, searching for new solutions. |
| The unknown scale of fuel poverty. | Buildings and heating<br>Energy system<br>Fair transition and social participation | • performing a thorough analysis of the scale and specifics of energy poverty in Warsaw, starting with the districts covered by the Climate City Contract,<br>• actions to design public policies (at national, regional, and local level) so that they can mitigate energy poverty,<br>• actions, through self-government organisations and the National Cooperation Platform, for eliminating legal barriers at national level restricting the development of energy communities,<br>• developing targeted financial support programmes for low-income households,<br>• expanding technical support systems for obtaining funding, selecting the right investments, and adapting energy community models to local conditions |
| Lack of a coherent climate policy at national, regional, and municipal level as well as systemic governance of climate issues (climate governance). | Buildings and heating<br>Energy system<br>Fair transition and social participation | • creating a systemic basis in the city for implementing climate policy by making climate goals strategic and giving transformative actions a strong mandate and placing them under the supervision of the city council,<br>• including climate risks into decision-making at the level of city management and in investment planning and implementation, |

| | | |
|---|---|---|
| | Green infrastructure and nature-based solutions<br>Transport<br>Waste management and GOZ<br>Fair transition and social participation | • structural strengthening of the units dealing with climate issues in the city,<br>• actions, through local government organisations and the National Cooperation Platform, towards creating, at national level, a coherent policy and consistent management of climate issues. |
| Insufficient support and involvement of the main political forces and the public in pro-climate measures. | Buildings and heating<br>Energy system<br>Fair transition and social participation<br>Green infrastructure and nature-based solutions<br>Transport<br>Waste management and GOZ<br>Fair transition and social participation | • developing educational, information, and promotional activities in the city,<br>• increasing the level of public participation and involvement of residents and other urban stakeholders in pro-climate projects and processes,<br>• actions, through local government organisations and the National Co-operation Platform, for creating, at national level, educational, information, and promotion programmes concerning pro-climate measures. |

## 3.3 Module B-3 Monitoring, evaluation and learning indicators

| **B-3.1: Impact pathways** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Addressed effects and impacts | Actions, projects | **Indicator number** (unique identifier) | Name of the indicator | | Target values[1] | | |
| | | | | | 2025 | 2027 | 2030 |
| (Enter the past and subsequent results and impacts that will be assessed using the indicator) | If possible, list activities or projects | (Enter indicator number) | (Insert name of indicator) | | (Exchange one value for one indicator) | (Exchange one value for one indicator) | (Exchange one value for one indicator) |
| Decrease in emissions from the Buildings and Heating sector | B-1<br>B-2<br>B-3<br>B-4 | 1 | Energy demand of modernised buildings | | - | - | - |
| Decrease in emissions from | B-1 | 2 | Share of the final energy of the | | - | - | - |

[1] Since we are working on a consistent monitoring system for all climate policy documents, values will be completed in future iterations.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| the Energy sector | B-2<br>E-1<br>E-2 | | retrofitted building coming from Renewable Energy Sources | | | | |
| Decrease in emissions from the Buildings and Heating sector | B-1<br>B-2<br>B-3<br>B-4 | 3 | Number of buildings with a demonstrated Primary Energy Ratio EP | | - | - | - |
| Reducing energy consumption within the city limits | E-7 | 4 | Energy efficiency of urban lighting | | - | - | - |
| Decrease in emissions from the Energy sector | E-1 | 5 | Share of "Green energy" in total purchased energy of the city | | - | - | - |
| Decrease in emissions from the Buildings and Heating sector | E-2 | 6 | Facilities connected to the city's heating network | | - | - | - |
| Decrease in emissions from the Energy sector | E-2<br>B-1<br>B-2 | 7 | Energy production from renewable sources | | - | - | - |
| Decrease in emissions from the Energy sector | E-4 | 8 | Electricity storage | | - | - | - |
| Decrease in emissions from the Energy sector | E-5 | 9 | Implementing SmartGRID | | - | - | - |
| Decrease in emissions from the Buildings and Heating sector | E-6 | 10 | Ecological heat sources | | - | - | - |
| Decrease in emissions from the Waste sector | W-1<br>W-2<br>W-3 | 11 | Generation of waste | | - | - | - |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Decrease in emissions from the Waste sector | W-2<br>W-3 | 12 | Selectively collected waste | | - | - | - |
| Decrease in emissions from the Waste sector | W-2<br>W-3 | 13 | Level of waste recovery and recycling | | - | - | - |
| Decrease in emissions from the Waste sector | W-4 | 14 | Biogas plants | | - | - | - |
| Developing bicycle and walking infrastructure | T-1 | 15 | Pedestrian and bicycle infrastructure | | - | - | - |
| Improving the residents' quality of life | T-1<br>T-2<br>T-3 | 16 | Satisfaction index with quality of urban travel | | - | - | - |
| Decrease in emissions from the Transport sector | T-3 | 17 | Electric vehicle charging stations | | - | - | - |
| Increase in biodiversity | G-1<br>G-2<br>G-3<br>G-4 | 18 | Retention potential indicator | | - | - | - |
| Increase in biodiversity | G-1<br>G-2<br>G-3<br>G-5 | 19 | Blue-green infrastructure | | - | - | - |
| Increase in biodiversity | G-4 | 20 | Water reservoirs | | - | - | - |
| Increase in biodiversity | G-1<br>G-2<br>G-3<br>G-5 | 21 | Green space resources | | - | - | - |
| Increase in biodiversity | G-5 | 22 | Protected areas | | - | - | - |

*Target values for indicators will be developed in subsequent iterations, as they need to take into account the specific characteristics of the districts (local opportunities and constraints), for which a detailed analysis is needed.

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Energy demand of modernised buildings |
| Indicator unit | % |
| Definition | Energy demand of modernised buildings |
| Method of calculation | Change in the energy demand of a building with respect to the demand in a reference year |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | yes |
| If so, which emission source sectors does it measure? | Stationary power generation |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Increasing energy efficiency, optimising energy consumption and installing renewable energy sources. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Buildings and heating |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | City of Warsaw |
| Is the data source local or national? | local |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | |
| Documents describing the indicator | Warsaw Green Building Standard |

| | |
|---|---|
| Other systems using this indicator | Warsaw Green Building Standard |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Share of the final energy of the modernised building coming from Renewable Energy Sources (RES) |
| Indicator unit | % |
| Definition | A minimum of 50% of final energy should come from renewable energy sources or through the purchase of energy certified by a certificate of origin. |
| Method of calculation | Final energy analysis by means of smart energy meters installed in retrofitted buildings |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | yes |
| If so, which emission source sectors does it measure? | Stationary power generation |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Increasing energy efficiency, optimising energy consumption and installing renewable energy sources. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Buildings and heating |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | yes |
| Data required | |
| Data source | City of Warsaw |
| Is the data source local or national? | local |
| Expected availability | easy |
| Suggested data collection interval | annual |

| References | |
|---|---|
| Documents describing the indicator | Warsaw Green Building Standard |
| Other systems using this indicator | Warsaw Green Building Standard |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Number of buildings with a demonstrated Primary Energy Ratio EP |
| Indicator unit | % |
| Definition | The number of newly commissioned buildings with a studied parameter that determines the amount of non-renewable final energy consumed that is needed to operate the building. |
| Method of calculation | Number of new buildings with analysis of non-renewable final energy consumed |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | no |
| If so, which emission source sectors does it measure? | not applicable |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Increasing energy efficiency, optimising energy consumption and installing renewable energy sources. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Buildings and heating |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | Central Statistical Office |

| | |
|---|---|
| Is the data source local or national? | national |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | |
| Documents describing the indicator | none |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Energy efficiency of urban lighting |
| Indicator unit | % |
| Definition | Share of energy-efficient LED luminaires in the city's lighting system |
| Method of calculation | Number of LED luminaires in relation to the total number of luminaires installed in the city. |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | no |
| If so, which emission source sectors does it measure? | not applicable |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Optimising energy consumption, environmental protection (progressive dimming or motion activation to control light intensity as required). |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Energy |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | City of Warsaw |

| | |
|---|---|
| Is the data source local or national? | local |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | |
| Documents describing the indicator | none |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Share of "Green energy" in total purchased energy of the city |
| Indicator unit | % |
| Definition | Share of "green energy" certified by the certificate of origin in the total purchased energy of the city |
| Method of calculation | Number of new buildings with analysis of non-renewable final energy consumed |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | yes |
| If so, which emission source sectors does it measure? | Energy |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Reducing the share of fossil fuel energy and using emission-free energy sources. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Energy |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | City of Warsaw |

| | |
|---|---|
| Is the data source local or national? | local |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | |
| Documents describing the indicator | none |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Facilities connected to the city's heating network |
| Indicator unit | % |
| Definition | Share of facilities connected to the city's heating network |
| Method of calculation | Number of buildings connected to the heating network in relation to all buildings in the city |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | no |
| If so, which emission source sectors does it measure? | not applicable |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Connecting more consumers to the central heating system reduces individual consumption of fossil fuels, results in more efficient use of energy and reduced heat transfer losses. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Buildings and heating, Energy |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |

| | |
|---|---|
| Data source | City of Warsaw + Veolia Energia Warszawa S.A. |
| Is the data source local or national? | local |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | |
| Documents describing the indicator | none |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Energy production from renewable sources |
| Indicator unit | MWh |
| Definition | Electricity generated by renewable energy sources located on land owned by the city and municipal companies |
| Method of calculation | Amount of energy produced by RES |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | yes |
| If so, which emission source sectors does it measure? | Energy |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Using renewable sources as much as possible by switching to RES at source or building low-temperature heating systems will significantly reduce emissions and improve air quality. |
| Is the indicator useful for monitoring the results/impact of activities? | Reducing demand for electricity and heat and using carbon-free energy sources |
| If so, for which activities and impact pathways is it useful? | Buildings and heating |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |

| Data required | |
|---|---|
| Data source | City of Warsaw + Energy Companies of Warsaw |
| Is the data source local or national? | local |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | |
| Documents describing the indicator | none |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Electricity storage |
| Indicator unit | kWh |
| Definition | The energy storage capacity of the city's non-renewable final energy that is needed to operate the building. |
| Method of calculation | The maximum storage potential in KWh |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | yes |
| If so, which emission source sectors does it measure? | Energy |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Local storage of electricity from renewable energy sources can be used as an energy buffer for the city's existing electricity grid and serve primarily to compensate for energy losses occurring on the grid. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Energy |

| | |
|---|---|
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | City of Warsaw |
| Is the data source local or national? | local |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | |
| Documents describing the indicator | none |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Implementing SmartGRID |
| Indicator unit | % |
| Definition | Share of connection points covered by SmartGRID |
| Method of calculation | Share of connection points covered by SmartGRID in relation to all points in the city connected to the city's electricity grid. |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | no |
| If so, which emission source sectors does it measure? | not applicable |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Monitoring and controlling how energy is distributed (in lines and in substations) as well as identifying consumer needs, to manage generation sources and to monitor energy flow lines, as well as to optimise energy flow from a cost and demand point of view |
| Is the indicator useful for monitoring the results/impact of activities? | Reducing demand for electricity and heat and using carbon-free energy sources |

| | |
|---|---|
| If so, for which activities and impact pathways is it useful? | Energy |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | City of Warsaw |
| Is the data source local or national? | local |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | |
| Documents describing the indicator | none |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Ecological heat sources |
| Indicator unit | % |
| Definition | Share of green heat sources in relation to all individual heat sources present in the city. |
| Method of calculation | Number of green heat sources in relation to all heat sources present in the city. |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | no |
| If so, which emission source sectors does it measure? | not applicable |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Reducing the city's CO2 emissions and improving air quality. Low emissions constitute the direct cause of smog in the city and its effects. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |

| | |
|---|---|
| If so, for which activities and impact pathways is it useful? | Buildings and heating |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | City of Warsaw |
| Is the data source local or national? | local |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | Expected availability |
| Documents describing the indicator | none |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Generation of waste |
| Indicator unit | kg |
| Definition | The indicator measures the mass of municipal waste generated per capita in kilograms per year. |
| Method of calculation | The indicator measures the mass of municipal waste generated per capita in kilograms per year. |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | no |
| If so, which emission source sectors does it measure? | not applicable |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Reducing the amount of waste will allow it to be recycled to a greater extent in line with the idea of a circular economy. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |

| | |
|---|---|
| If so, for which activities and impact pathways is it useful? | Waste |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | Central Statistical Office |
| Is the data source local or national? | national |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | |
| Documents describing the indicator | Local Data Bank of the Central Statistical Office |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Selectively collected waste |
| Indicator unit | % |
| Definition | The indicator measures the percentage of separately collected waste in relation to the city's total waste. |
| Method of calculation | The ratio of selectively collected waste to the total waste collected in the city is calculated. |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | no |
| If so, which emission source sectors does it measure? | not applicable |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Increasing the percentage of separately collected waste will enable it to be recycled to a greater extent and is going to allow reducing consumption-based emissions. |

| | |
|---|---|
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Waste |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | Central Statistical Office - Local Data Bank |
| Is the data source local or national? | national |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | |
| Documents describing the indicator | Local Data Bank of the Central Statistical Office |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Level of waste recovery and recycling |
| Indicator unit | % |
| Definition | Level of waste recovery and recycling |
| Method of calculation | Comparing waste recovery and recycling rates in the city |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | no |
| If so, which emission source sectors does it measure? | not applicable |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Increased investments in environmental education will help to reduce consumption-based emissions, while more efficient and high-tech waste treatment |

| | |
|---|---|
| | will contribute to strengthening the city's energy security. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Waste |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | Central Statistical Office - Local Data Bank |
| Is the data source local or national? | national |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | |
| Documents describing the indicator | Local Data Bank of the Central Statistical Office |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Biogas plants |
| Indicator unit | kWh |
| Definition | Amount of energy produced from biogas |
| Method of calculation | The indicator indicates how much energy was produced from biogas at the "Czajka" and "Południe" plants as well as the newly established ones. |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | yes |
| If so, which emission source sectors does it measure? | Energy, Waste |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |

| | |
|---|---|
| If so, what co-benefits does this indicator measure? | Obtaining energy from biogas will help to increase the city's energy security. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Energy, Waste |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | Miejskie Przedsiębiorstwo Wodociągów i Kanalizacji of Warsaw (MPWiK) |
| Is the data source local or national? | local |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | |
| Documents describing the indicator | MPWiK annual report |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Pedestrian and bicycle infrastructure |
| Indicator unit | km/km2 |
| Definition | Length of bicycle paths in kilometres in relation to the District's area. |
| Method of calculation | The indicator measures the ratio of the length of bicycle paths located in a given district to the total area of the district. |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | no |
| If so, which emission source sectors does it measure? | not applicable |

| | |
|---|---|
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Increasing the length of bicycle paths in the districts will have a positive impact on the quality of life of the residents, as well as ensuring higher road safety. Creating better conditions for walking or cycling can encourage more people to use low carbon modes of transport and thus contribute to improving air quality in the city. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Transport |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | Public Roads Authority in Warsaw (ZDM) |
| Is the data source local or national? | local |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | |
| Documents describing the indicator | ZDM annual report |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Satisfaction index with quality of urban travel |
| Indicator unit | % |
| Definition | The indicator determines the share of people whose arithmetic mean of ratings for each mode of travel is 7 or more on a scale of 1-10 |
| Method of calculation | Please rate using a scale of 1 to 10, where 1 means very bad and 10 means very good, the quality of travelling through Warsaw by the following means: - public transport - bicycle - train (SKM, WKD, KM) and |

| | |
|---|---|
| | please rate the quality of travelling through Warsaw on foot. |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | no |
| If so, which emission source sectors does it measure? | not applicable |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Good quality public transport will allow improving the quality of life for male and female residents and may therefore encourage more people to switch from individual modes of transport. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Transport |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | Warsaw Barometer |
| Is the data source local or national? | local |
| Expected availability | easy |
| Suggested data collection interval | quarterly |
| References | |
| Documents describing the indicator | Report from a study of the needs, attitudes, and opinions of Warsaw's residents concerning the quality of Warsaw's functioning |
| Other systems using this indicator | #Warsaw2030 strategy |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Electric vehicle charging stations |
| Indicator unit | pcs/person |

| | |
|---|---|
| Definition | The indicator presents the number of publicly accessible existing electric vehicle charging stations per population |
| Method of calculation | The total number of publicly accessible existing electric vehicle charging stations is converted per unit area of the District. |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | no |
| If so, which emission source sectors does it measure? | not applicable |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Increasing the number of charging stations for electric vehicles will help to increase their uptake and thus reduce greenhouse gas emissions. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Transport |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | Data from companies overseeing and managing the charging station infrastructure in the city |
| Is the data source local or national? | local |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | |
| Documents describing the indicator | none |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** |
|---|
| For each of the selected indicators |

| | |
|---|---|
| Name of the indicator | Retention potential indicator |
| Indicator unit | % |
| Definition | Share of biologically active area in total area |
| Method of calculation | Share of total biologically active area in the total area of the District. |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | no |
| If so, which emission source sectors does it measure? | not applicable |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Increasing the biologically active area is intended to increase the retention of rainwater, as well as lowering temperatures and increasing humidity, which will result in improved living comfort for residents, as well as an increase in biodiversity. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Green infrastructure and nature-based solutions |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | Data from the City of Warsaw,<br>Topographic Object Database 10k,<br>Central Statistical Office |
| Is the data source local or national? | Local and national |
| Expected availability | easy |
| Suggested data collection interval | On an ongoing basis |
| References | |
| Documents describing the indicator | "Nature-climate indicators of sustainable urban development. A guide for cities" Ministry of Climate and Environment |
| Other systems using this indicator | none |

| B-3.2: Metadata of indicators | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Blue-green infrastructure |
| Indicator unit | % |
| Definition | Percentage of the District's area occupied by blue-green infrastructure. |
| Method of calculation | Share of the area occupied by blue-green infrastructure in the total area of the district. |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | no |
| If so, which emission source sectors does it measure? | not applicable |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Increasing the blue-green infrastructure section of the district's surface is intended to increase the retention capacity concerning rainwater, as well as lowering temperatures and increasing humidity, which will result in an improved quality of life for residents, as well as an increase in biodiversity. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Green infrastructure and nature-based solutions |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | Data from the City of Warsaw,<br>Topographic Object Database 10k, |
| Is the data source local or national? | National and local |
| Expected availability | easy |
| Suggested data collection interval | on an ongoing basis |
| References | |

| | |
|---|---|
| Documents describing the indicator | none |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Water reservoirs |
| Indicator unit | km2/km2 |
| Definition | Area of water bodies per area of the District |
| Method of calculation | The indicator measures the area of water bodies per km2 of the District's surface area. |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | no |
| If so, which emission source sectors does it measure? | not applicable |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Increasing the number of water bodies will help to lower temperatures and increase humidity, as well as improve air quality and microclimates, which contribute to improving the quality of life for residents, as well as increasing biodiversity. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Green infrastructure and nature-based solutions |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | Greenery Board of Warsaw |
| Is the data source local or national? | local |
| Expected availability | easy |
| Suggested data collection interval | on an ongoing basis |

| References | |
|---|---|
| Documents describing the indicator | none |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Green space resources |
| Indicator unit | % |
| Definition | Share of communal green spaces in the District's area. |
| Method of calculation | The percentage of green spaces in the total area of the District. |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | no |
| If so, which emission source sectors does it measure? | not applicable |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Increasing the area of green space will make a significant contribution to improving air quality and the microclimate, as well as lowering temperatures and increasing humidity. Supporting the growth of biodiversity will also be important. All these beneficial effects will improve the quality of life for residents. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Green infrastructure and nature-based solutions |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |
| Data required | |
| Data source | Data from the City of Warsaw,<br>Topographic Object Database 10k, |

| | |
|---|---|
| | Central Statistical Office |
| Is the data source local or national? | Local, national |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | |
| Documents describing the indicator | "Climate change adaptation manual for cities" Institute of Environmental Protection, Local Data Bank, "Nature-climate indicators for sustainable urban development. A guide for cities" Ministry of Climate and Environment |
| Other systems using this indicator | none |

| **B-3.2: Metadata of indicators** | |
|---|---|
| For each of the selected indicators | |
| Name of the indicator | Protected areas |
| Indicator unit | % |
| Definition | Share of legally protected areas in the total area of the Districts |
| Method of calculation | The indicator is calculated as the proportion of the district's total legally protected areas by its area. |
| Context of the indicator | |
| Does the indicator measure direct impacts (reduction of greenhouse gas emissions)? | no |
| If so, which emission source sectors does it measure? | not applicable |
| Does the indicator measure indirect impacts (e.g. co-benefits)? | yes |
| If so, what co-benefits does this indicator measure? | Increasing the extent of protected areas helps to support the growth of biodiversity. |
| Is the indicator useful for monitoring the results/impact of activities? | yes |
| If so, for which activities and impact pathways is it useful? | Green infrastructure and nature-based solutions |
| Is the indicator taken into account by existing methodologies - CDP/CIRIS/Covenant of Mayors | no |

| Data required | |
|---|---|
| Data source | Data from the City of Warsaw,<br>Central Statistical Office |
| Is the data source local or national? | Local, national |
| Expected availability | easy |
| Suggested data collection interval | annual |
| References | |
| Documents describing the indicator | Local Data Bank of the Central Statistical Office |
| Other systems using this indicator | none |

# 4. Part C - Enabling climate neutrality by 2030

## 4.1 Module C-1 Innovation interventions in terms of organisation and management

**C-1.1: Description or visualisation of a participatory governance model to achieve climate neutrality**

The city cannot achieve the targets set in the CCC on its own, given that its units are only directly responsible for 7.5% of emissions. Achieving the 80% reduction target in the selected districts will only be possible with the involvement of a wide range of stakeholders and gaining broad public acceptance, and that is why the implementation process involves the active participation of stakeholders at many levels. This process is based on bodies that already exist (Climate Team, Transition Team) or are currently being constituted (National Cooperation Platform). The activities carried out within the CCC will be coordinated by the Department of Air Protection and Climate Policy, a unit established in the City of Warsaw to initiate and coordinate operations in favour of the climate.

Elements of multi-level process management:

**An internal Transition Team**, made up of city officials, employees of city companies, and representatives of districts, will mainly deal with agreeing on the operational aspects of activities and plans that require cross-sectoral coordination and cooperation, discussing their implementation and needed adjustments. The internal Transition Team will also commission analyses concerning the impact of individual measures on various aspects of the city's functioning, particularly in terms of a just climate transition and the impact on residents' health and well-being. It will also cooperate with the External Transition Team within the framework of sectoral cooperation (concerning transport, energy, buildings, etc.).

**The External Transition Team**, composed additionally of city stakeholders (contract signatories and other interested representatives from business, science, civil society, and public institutions) will be in charge of: agreeing on sectoral activities and priorities, determining the field of cooperation,

the contribution of individual stakeholders to the action, responsibilities and methods for verifying the effectiveness of the action, discussing the degree of implementation of the action, and needed adjustments.

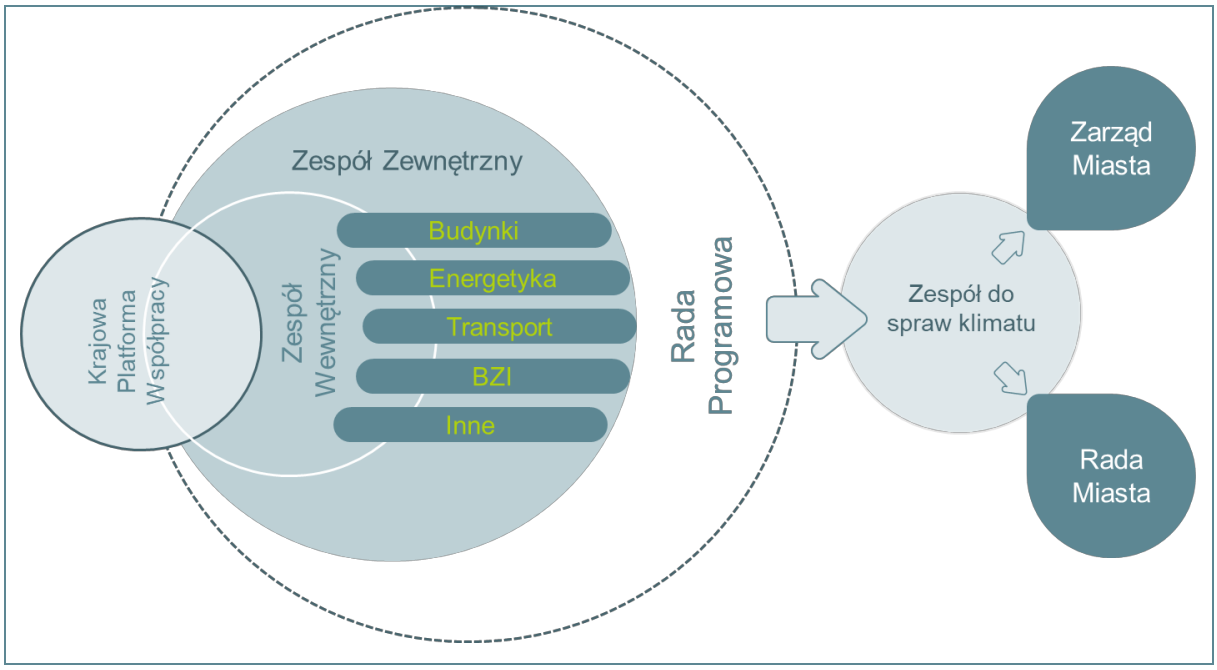
Due to the large number of stakeholders, meetings focusing on specific sectors (buildings, energy, transport, etc.), among stakeholders involved in the sector, will be most appropriate. The External Transition Team will be able to set up working groups of selected stakeholders to work on developing new solutions (technical, organisational, funding, etc.), problem solving or project groups. It will also constitute a forum where stakeholders can share their knowledge, experiences, solutions and invite experts from specific fields with knowledge that can support particular activities or the CCC process itself.

**The Programme Board** - will meet periodically. These will be meetings of the entire Transition Team, with the participation of representatives of the boards of the districts implementing the climate contract and of the district councils, representatives of the government and central institutions, representatives of regional authorities, with the possibility of residents' participation. It will discuss crucial action plans and priorities, analyse the workflow and monitoring results, identify the needed directional changes, discuss proposals, as well as identify barriers and needs. The Board will also recommend the need to update the Climate City Contract.

**National Cooperation Platform** - bringing together representatives of the cities participating in the EC Mission and representatives of the Polish government, mainly ministries that are signatories to the CCC. Its aim is to discuss the manners of the needed support (legislative, financial, technical, etc.) and the necessary interventions at the national level to enable the CCC to be implemented and potential barriers to be addressed.

**Climate Team** - the results of monitoring the implementation of the Climate City Contract will be presented to the Climate Team. Key implementation findings and needs to support the implementation of activities or adjustments of activities at the strategic level (including CCC updates) will also be addressed to the team. The team will issue recommendations to the City Board concerning the mobilisation of additional resources or actions to facilitate, streamline contract implementation, and deal with identified barriers.

Reports concerning the progress in implementing the Climate City Contract will also be reported periodically to **the City Board** and **Warsaw City Council as well as the boards and councils of the mission districts.**




| C.1.2: Relationships between management innovation, systems, and impact pathways | | | | | |
|---|---|---|---|---|---|
| Action name | Description | Addressed system barriers / development opportunities | Authorities and stakeholders involved | Possible impact | Co-benefits |
| (Provide action name) | (Describe the content of the action) | (Refer to system barriers or development opportunities from Module A-3) | (List the leaders and all stakeholders involved, referring to the stakeholders mapped in Module A-3). | (Describe the impact of the action on achieving climate neutrality) | (Indicate how the action helps to achieve the impact mentioned in Module B-1). |
| Interdisciplinary structures at the City of Warsaw | Appointing structures with an interdisciplinary character (Internal Transition Team, Climate Team) in the City of Warsaw, dealing with the coordination or management of processes that go beyond the narrow specialisation of the office's units. | Silo character of work in the City of Warsaw, dispersion and poor coordination of activities and communication.<br>Lack of a developed network of local and district centres<br>Constraints in terms of developing blue-green infrastructure (BZI).<br>Difficulties in using data. | Self-government: cells and units of the City of Warsaw, municipal companies | Better allocation of resources and coordination of actions, communication, ability to use various sources of expertise. | Reduction of the city's CO2e emissions.<br>Improving air quality.<br>Strengthening the city's energy security.<br>Improving the residents' quality of life.<br>Increased road safety.<br>Development of competences in local government.<br>Improving the resilience of buildings to the |

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| | | High costs and unknown scale of energy efficiency needs for buildings.<br>Problems with rainwater use.<br>The unknown scale of fuel poverty.<br>Financial barriers. | | | effects of climate change and protecting the health of residents.<br>Reducing costs and improving the financial situation of the local government. |
| Cooperation with representatives of the central administration within the framework. | Systematic meetings with central government representatives as part of the National Cooperation Platform to address needs and problems. | Dependence on the National Grid<br>System barriers to RES development.<br>Financial barriers.<br>High costs and unknown scale of energy efficiency needs for buildings.<br>Limited direct impact on the city's greenhouse gas emissions. | Local Government: Air Protection and Climate Policy Department<br>Central administration: Ministry of Climate and Environment | Direct feedback to central administration.<br>Cooperation concerning developing systemic solutions. | Reduction of the city's CO2e emissions.<br>Strengthening the city's energy security.<br>Improving the residents' quality of life.<br>Reducing costs and improving the financial situation of the local government.<br>Improving the resilience of buildings to the effects of climate change and protecting the health of residents.<br>Improving the effectiveness of implementing pro-climate measures |
| Cooperation with urban stakeholders. | Systematic meetings with urban stakeholders within the External Transition Team and within the Climate Partnership platform. | Limited direct impact on the city's greenhouse gas emissions.<br>High costs and unknown scale of energy efficiency needs for buildings.<br>Problems with rainwater use.<br>Financial barriers.<br>Difficulties in using data.<br>Constraints in terms of developing blue-green infrastructure (BZI). | Self-government: cells and units of the City of Warsaw, municipal companies<br>State-owned energy companies (energy producers) and energy distributors.<br>National Fund for Environmental Protection and Water Management and other operators of funding programmes<br>Science sector | Cooperation in terms of developing systemic solutions.<br>Working out solutions for sectors in sector groups.<br>Co-funding or funding activities.<br>Stakeholders' own actions.<br>Seeking new sources of funding.<br>Seeking technology and organisational solutions.<br>Legal and organisational initiatives | Reduction of the city's CO2e emissions.<br>Improving air quality.<br>Strengthening the city's energy security.<br>Improving the residents' quality of life.<br>Competence development in local government and among stakeholders.<br>Improving the resilience of buildings to the effects of climate change and protecting the |

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| | | Lack of a developed network of local and district centres | Manufacturing, trading, service companies<br>Construction and renovation companies as well as cooperatives and housing associations<br>Residents.<br>NGOs. | addressed to central authorities.<br>Exchanging experience and know-how.<br>Joint projects. | health of residents.<br>Reducing costs and improving the financial situation of the local government.<br>Supporting the development of biodiversity.<br>Improving the effectiveness of implementing pro-climate measures<br>Supporting the involvement of the private sector. |

## 4.2 Module C-2 Social innovation interventions

**C.2.1 Example table: Relationships between social innovation, systems and impact pathways**

| Action name | Description | Addressed system barriers / development opportunities | Authorities and stakeholders involved | Possible impact | Co-benefits |
|---|---|---|---|---|---|
| (Provide action name) | (Describe the content of the action) | (Refer to system barriers or development opportunities from Module A-3) | (List the leaders and all stakeholders involved, referring to the stakeholders mapped in Module A-3). | (Describe the impact of the action on achieving climate neutrality) | (Indicate how the action helps to achieve the impact mentioned in Module B-1). |
| Warsaw Booster acceleration programme | The city's acceleration programme for innovative projects and start-ups, which supports young technology companies in improving their business competences and accelerates the development of business projects, increasing their chances of being implemented in the market. | Difficulties in using data.<br>Lack of a developed network of local and district centres<br>Constraints in terms of developing blue-green infrastructure (BZI).<br>Unknown scale of needs concerning increasing the energy efficiency for buildings.<br>The unknown scale of energy poverty. | Local Government: Economic Development Department<br>The cells and units of the City of Warsaw, municipal companies<br>Service companies (new technologies) | City support for projects that will facilitate developing analytical tools and related to using new technologies for supporting the activities of the Climate City Contract and overcome barriers. | Reduction of $CO_2$ emissions.<br>Improving the residents' quality of life.<br>Increased road safety.<br>Introducing the idea of a 15-minute city and community - improving the accessibility of city services for the residents of the two districts of Praga-Południe and Ursynów.<br>Improving the effectiveness of implementing pro-climate measures. |

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| | | | | | Developing competences in local government and among cooperating stakeholders.<br>Supporting the involvement of the private sector.<br>Strengthening the city's energy security. |
| Research Issues Exchange | A networking project aimed at increasing cooperation between the local government and the scientific community. Employees of the local government publish topics concerning which they require knowledge and research-based solutions. Representatives of scientific institutions make proposals to cooperate and carry out research projects. | Financial barriers.<br>Lack of a developed network of local and district centres<br>Constraints in terms of developing blue-green infrastructure (BZI).<br>Unknown scale of needs concerning increasing the energy efficiency for buildings.<br>The unknown scale of fuel poverty.<br>Difficulties in using data.<br>Problems with rainwater use. | Local Government: Strategy & Analysis Department<br>The cells and units of the City of Warsaw, municipal companies<br>Science sector: universities and scientific institutions | The Research Issues Exchange will facilitate networking and the search for appropriate partners from the scientific world to address barriers and challenges to the research, analysis and solutions needed to implement the Climate City Contract. | Reduction of $CO_2$ emissions.<br>Improving the effectiveness of implementing pro-climate measures.<br>Developing competences in local government and among cooperating stakeholders.<br>Supporting the involvement of the private sector.<br>Improving the effectiveness of implementing pro-climate measures. |
| Urban Living Lab | A working method for generating innovative solutions and supporting innovation. A collaborative instrument between city authorities and citizens, businesses and research actors aimed at bringing together city resources and innovative solutions to solve problems and improve the quality of life of citizens. | Financial barriers.<br>Lack of a developed network of local and district centres<br>Constraints in terms of developing blue-green infrastructure (BZI).<br>Unknown scale of needs concerning increasing the energy efficiency for buildings.<br>The unknown scale of fuel poverty.<br>Difficulties in using data. | Local Government: Economic Development Department<br>The cells and units of the City of Warsaw, municipal companies<br>Science sector: universities and scientific institutions<br>Manufacturing, trading, service companies<br>Residents. | Actions in terms of the Living Lab involving a large number of diverse urban stakeholders will increase the chance of developing innovative solutions and taking diverse needs into account concerning the planned activities. | Reduction of $CO_2$ emissions.<br>Improving the residents' quality of life.<br>Increased road safety.<br>Introducing the idea of a 15-minute city and community - improving the accessibility of city services for the residents of the two districts of Praga-Południe and Ursynów.<br>Improving the effectiveness of implementing pro-climate measures.<br>Developing competences in |

| | | | | | |
|---|---|---|---|---|---|
| | | Problems with rainwater use. | | | local government and among cooperating stakeholders.<br>Supporting the involvement of the private sector.<br>Strengthening the city's energy security. |
| WawaShare | A virtual space including posted projects concerning sharing economy and circular economy implemented by the City of Warsaw and Warsaw-based entrepreneurs, associations and foundations. The aim is to support and promote these projects as well as to create an urban sharing economy system. | Increasing the level of efficiently using resources.<br>Limited direct impact on the city's greenhouse gas emissions. | Local Government: Economic Development Department<br>Science sector<br>Manufacturing, trading, service companies<br>Residents.<br>NGOs.<br>Institutions. | Promoting and mapping good practices and places dedicated to the sharing economy can increase the scale of residents' activities concerning reusing resources and influence the emergence of more sharing economy facilities and activities. | Reduction of consumption-based emissions. |
| Participatory Budgeting | Under the participatory budgeting, residents decide what part of Warsaw's budget should be spent on. Every year, residents come up with and submit projects and then vote to select those to be implemented, thus deciding on investments in their immediate vicinity, in several districts, or in the entire Warsaw. | Limited direct impact on the city's greenhouse gas emissions.<br>Constraints in terms of developing blue-green infrastructure (BZI).<br>Problems with rainwater use. | Local Government: Centre for Public Communication<br>Residents. | Residents can decide on a number of short-term (implementation during year) (?). With appropriate education and outreach activities, residents of the Climate City Contract districts can submit projects to support its implementation. | Reduction of $CO_2$ emissions.<br>Improving air quality.<br>Improving the microclimate.<br>Lowering the temperature and increasing the humidity.<br>Improving the residents' quality of life.<br>Water consumption savings.<br>Supporting the development of biodiversity.<br>Including the activities of the Climate Change Adaptation Mission into the CCC. |
| Partnership for Climate | A multi-stakeholder cooperation platform for exchanging experience, education, and joint projects concerning climate protection. | Financial barriers.<br>Lack of a developed network of local and district centres<br>Constraints in terms of | Local Government: Air Protection and Climate Policy Department<br>NGOs<br>Companies<br>Institutions | Through educational activities, exchanging knowledge and experience, as well as financial commitment, technology transfer of actors, involvement of the | Reducing costs and improving the financial situation of the local government.<br>Reducing $CO_2$ emissions. |

| | | | | | |
|---|---|---|---|---|---|
| | | developing blue-green infrastructure (BZI).<br>Unknown scale of needs concerning increasing the energy efficiency for buildings.<br>The unknown scale of fuel poverty.<br>Difficulties in using data.<br>Problems with rainwater use.<br>Limited direct impact on the city's greenhouse gas emissions. | Scientific institutions<br>Diplomatic institutions | organisation's resources in specific projects, educational, promotional and networking activities, the platform can be a great support for implementing the measures envisaged in the Climate City Contract. | Supporting the development of biodiversity<br>Improving the effectiveness of implementing pro-climate measures.<br>Developing competences in local government and among cooperating stakeholders.<br>Supporting the involvement of the private sector. |
| Green Fund for Warsaw | The aim of the Green Fund for Warsaw is to enable entrepreneurs and other entities to participate in developing and maintaining green spaces in the city. | Limited direct impact on the city's greenhouse gas emissions.<br>Constraints in terms of developing blue-green infrastructure (BZI).<br>Problems with rainwater use. | Local government: Greenery Board of Warsaw.<br>Manufacturing, trading, service companies | By financially supporting the Green Fund for Warsaw, companies can help prevent the effects of climate change and contribute to increasing the capital's biodiversity by funding investments in urban green spaces: parks, squares, and green belts along streets. | Reducing costs and improving the financial situation of the local government.<br>Reducing $CO_2$ emissions.<br>Supporting the development of biodiversity<br>Improving the effectiveness of implementing pro-climate measures.<br>Supporting the involvement of the private sector. |

## C-2.2: Description of innovative social measures

Warsaw is implementing a number of initiatives and projects in the area of innovative social measures aimed at meeting real social needs and solving specific problems. The objective of social innovations is to develop processes and tools for addressing future challenges. Their characteristic feature consists in the involvement of urban stakeholders in their development, to whom the developed ideas and solutions are addressed.

Warsaw is implementing the "**Generate Innovation Programme"**, which was adopted for implementation by order of the Mayor of Warsaw 1947/2021 on 9 December 2021 as an executive programme for one of the objectives. "#Warsaw2030 Strategy". The programme is addressed at Warsaw-based creatives and innovators - representatives of startups, creative and innovative companies, scientists, artists, and cultural creators. The programme is also aimed at institutional actors from the business, science, culture, and business environment sectors. An important group of stakeholders in the programme are the employees of the local government administration of Warsaw.

Some of the projects implemented under the programme can be used to meet the objectives of the Climate City Contract. The experiences and developed tools can also be used as inspiration for further innovative initiatives.

**The Warsaw Booster programme**, which serves as an accelerator for innovative projects and start-ups, can generate ideas to be used in contract activities. The **Research Issue Exchange** can be used in a similar manner for joint research projects between the scientific world and local governments, as well as **the Urban Living Lab**, which aims to generate innovative solutions and foster innovation in response to real needs and challenges in the city.

**The WawaShare programme** stimulates residents and city stakeholders to engage in activities related to the circular economy.

Other social innovations, implemented independently of the "We Generate Innovations" programme include:

**Participatory Budgeting** (BO), which mobilises specific financial resources for residents and the support of officials to implement the ideas they have developed for specific urban investments. Although, the most common ideas put forward and implemented concern the development of green spaces.

**Partnership for Climate,** which is a platform for exchanging knowledge, experience, ideas, but also a place where ideas for implementing specific projects in the city are generated. It brings together diverse stakeholders (NGOs, businesses, institutions, universities, diplomatic missions).

**Green Fund for Warsaw** - a fund dedicated to entrepreneurs. It allows funding measures in favour of developing green spaces in the city. Following its example, Warsaw plans to set up a Sustainable Energy Investment Fund that would have the potential to raise funds from external sources for measures related to reducing greenhouse gas emissions, including support for developing RES and improving energy efficiency.

In the years 2020-2021, Warsaw also organised its first citizens' panel, **the Warsaw Climate Panel.** 90 residents, selected at random, decided on climate policy in the area of increasing Warsaw's energy efficiency and the share of renewable energy sources in the city's energy balance. The 49 recommendations developed and voted on by the panellists are now being implemented in the city. Citizen panels could be another social innovation to be used for developing solutions to the challenges of implementing the Climate City Contract.

# 5. Prospects and following steps

**The planned activities for the following iterations of the Climate Contract Action Plan**

The initial version of the Action Plan contains key assumptions and a description of activities developed on the basis of those included in the Green Vision for Warsaw (with the assumption of intensifying them and increasing their scale in the districts covered by the Climate City Contract), supplemented by ideas for additional activities aimed at closing the emissions gap. Due to a lack of sufficient data, the scale and scope of activities has, in this version of the Action Plan, been developed at a general level and includes approximate values.

Future iterations of the Action Plan will address the following issues:

- **Taking into account the specific characteristics of the districts**. All planned activities require a more accurate estimation of the possible scale of implementation separately for each

district. This estimation must take into account the opportunities that exist within them to accelerate, increase the scope and intensity of activities, and the possibility of applying new solutions to close the emissions gap. On this basis, action plans will be refined, reviewed, and missing activities are going to be added.

- **Identifying thermal modernisation needs in districts.** In order to more accurately determine the needs of the mission districts for the deep thermal modernisation of buildings, an inventory of the buildings in terms of their energy intensity must be prepared. On the basis of this, specific quarters requiring deep thermal modernisation as a matter of priority (municipal and private buildings) will be identified. The successive addition of new data to the national Integrated Low Emission Reduction System (ZONE), of which the Central Emission Inventory for Buildings (CEEB) is a part will be helpful in this regard. Additional measures on the part of the city, such as thermal imaging mapping of buildings, are also being considered.
- **Analysing the potential for developing RES in districts**. In order to maximise using the possibilities of decarbonisation by increasing the share of RES in the energy mix of districts, a thorough analysis should be carried out concerning the possibilities of using various sources of renewable energy. It must concern examining the potential of the roofs of buildings in districts (particularly large-scale buildings), the roofing of car parks and sheds, as well as sites suitable for ground-mounted installations, for photovoltaic systems. There must also be an analysis concerning the use of renewable energy sources in heating on a larger scale: the possibility of installing heat pumps (large-scale, smaller, individual), the use of ambient heat (shallow geothermal, deep geothermal), heat from sustainable biomass (certified) and other sources (solar panels, biomethane/biogas). The potential for RES energy storage is also to be explored. The results of the analysis will be incorporated into a revised Action Plan.
- **Analysis of the potential of municipal companies for RES development**. Selected municipal companies own properties in the mission districts (e.g. Miejskie Zakłady Autobusowe - Zajezdnia Autobusowa Ostrobramska, Warszawskie Metro - Stacja Techniczno-Postojowa Kabaty). The potential of these properties for RES investments, on the basis of which specific investments will be planned, is to be examined.
- **Examining the opportunities to provide green energy to districts**. Subsequent iterations of the Action Plan will require assessing the feasibility and cost-effectiveness of increasing the level of green energy produced outside the administrative boundaries of the mission districts. This concerns both purchasing certified green energy from the National Grid and using energy generated from municipal sources - generated by municipal companies or entities of Warsaw.
- **Mapping and analysing the potential waste heat source potential.** Subsequent iterations must include a map of waste heat sources created together with stakeholders and an analysis of the possibilities for their use. Currently, the possibility of using waste heat from the metro for heating and hot water in flats is being examined in cooperation with the Kingdom of Denmark and Danish companies, and the possibility of feeding heat from the metro into the Warsaw district heating network is being examined in cooperation with Veolia Energia Warszawa. Miejskie Przedsiębiorstwo Wodociągów i Kanalizacji is also exploring the possibility of recovering heat from municipal wastewater in cooperation with energy distributors PGNiG TERMIKA S.A. and Veolia Energia Warszawa. Zakład Unieszkodliwiania Stałych Odpadów Komunalnych (Municipal Solid Waste Treatment Plant) is being modernised and expanded (with the addition of a thermal waste treatment plant). The plant will process almost 300,000 tonnes of waste per year, producing heat and electricity for the city. Other sources of waste

heat recovery, such as industrial processes, server rooms, refrigeration processes, transport, are to be explored and mapped, together with municipal stakeholders. The results of these studies, and the resulting plans for the mission districts, will be taken into account in subsequent versions of the Action Plan.

- **Taking into account the phenomenon of energy poverty**. The phenomenon of energy poverty is not yet thoroughly examined in Warsaw. Currently, the Scientific Foundation of the Institute for Structural Research (IBS), at the commission of C40 Cities, is preparing a tool for Warsaw to support investment decisions concerning thermal modernisation of buildings based on energy poverty criteria, which will be handed over to Warsaw. A thorough analysis of the phenomenon in the mission districts, in terms of specificity and scale of occurrence, will be crucial for developing specific equitable transformation solutions and support processes for the poorest groups that will be included in the following iterations of the Action Plan.
- **Analysis of the potential for developing electromobility.** Also to be explored and incorporated into the plans that will emerge in the following iterations of the Action Plan is a thorough examination of the potential for developing electromobility in the mission districts in two areas: the possibility of developing a network of electric vehicle charging stations and hubs, and the possibility of increasing the number of bus routes served by electric buses.
- **Stakeholder collaboration plans.** Subsequent iterations of the document will include increasingly concrete plans of action and ways to support implementing the Climate City Contract obtained from key stakeholders. These will be developed during the collaboration in terms of the External Transition Team and individual agreements. This includes municipal stakeholders (municipal companies), private actors, NGOs, companies, institutions.
- **Activities carried out in terms of agreements with energy producers and suppliers**. A strategic partnership with the energy sector is required (due to the city's dependence on independent energy suppliers) in order to implement key measures related to the decarbonisation of heat and power production. Thanks to agreements with electricity and heat suppliers, it will be possible to identify more precisely the opportunities to increase the share of renewable energy supplied from the grid to CCC districts, energy storage and opportunities to reduce energy losses on transmission networks and distribution lines, and to plan specific actions for subsequent iterations of the document.
- **Systemic barrier solutions**. Representatives of the cities participating in the EC Mission and representatives of the Government of the Republic of Poland (the ministries most important for implementing the CCC) work together in a National Cooperation Platform to discuss ways of required support (legislative, financial, technical, etc.) and necessary interventions at the national level to enable implementing the CCC and eliminating systemic barriers. Meetings have already taken place concerning the sources of funding for decarbonisation measures and the barriers to using them, as well as concerning the needs of local governments for support from the Polish Government. A following meeting is planned to discuss the draft National Energy and Climate Plan 2021-2030. The developed solutions will be taken into account in subsequent iterations of the Action Plan.
- **Engaging private capital**. In the following iterations of the Action Plan, sources of funding for individual measures will be supplemented, with a particular focus on involving private capital, such as Public-Private Partnerships (PPP), Energy Service Company (ESCO) formulas, or through establishing dedicated funds for various measures, e.g. the Energy Service Company

(ESCO). Sustainable Energy Investment Fund - along the lines of the Green Fund for Warsaw, which has been operating in the city for several years and provides an opportunity for private entities to finance municipal investment in blue-green infrastructure.

- **Detailed implementation plans**. With subsequent iterations, starting from Q4 2024, the actions contained in the document will be detailed and specific cells and units of Warsaw will be assigned to them, responsible for their implementation, in accordance with their terms of reference. It will also include more specific commitments from individual stakeholders. An important element will also consist in finding a way or designing a process for working on the document "in constant change", which is not currently practised in city document structures.
- **Development plan for the blue-green infrastructure.** The following versions of the document will detail an action plan for developing the blue-green infrastructure for the mission districts, based on a specific analysis of needs and risks, including: information concerning valuable areas threatened by urbanisation pressures, information on the potential for increasing planting areas for various layers of vegetation, an inventory of potential land to be purchased for investment in blue-green infrastructure. The plan will also include a description of ways to eliminate or reduce the impact of the diagnosed threats, actions to create or restore internal natural links in the districts, plans to limit urbanisation of areas predisposed to the creation of blue-green infrastructure (including for as yet unurbanised agricultural and post-agricultural land and forest in the Ursynów District and areas providing biological cover for surface waters), a plan for the protection and development of public green areas and protection of forest resources, measures to reduce investment pressure on hydrologically active areas, and a plan for on-site rainwater management and reduction of soil sealing.
- **The concept of creating a 15-minute city.** Discussions are currently being carried out with representatives of the University of Warsaw in terms of producing a feasibility study and plan for the mission districts on how their urban space can be transformed in line with the 15-minute city concept.

# 6. Appendices

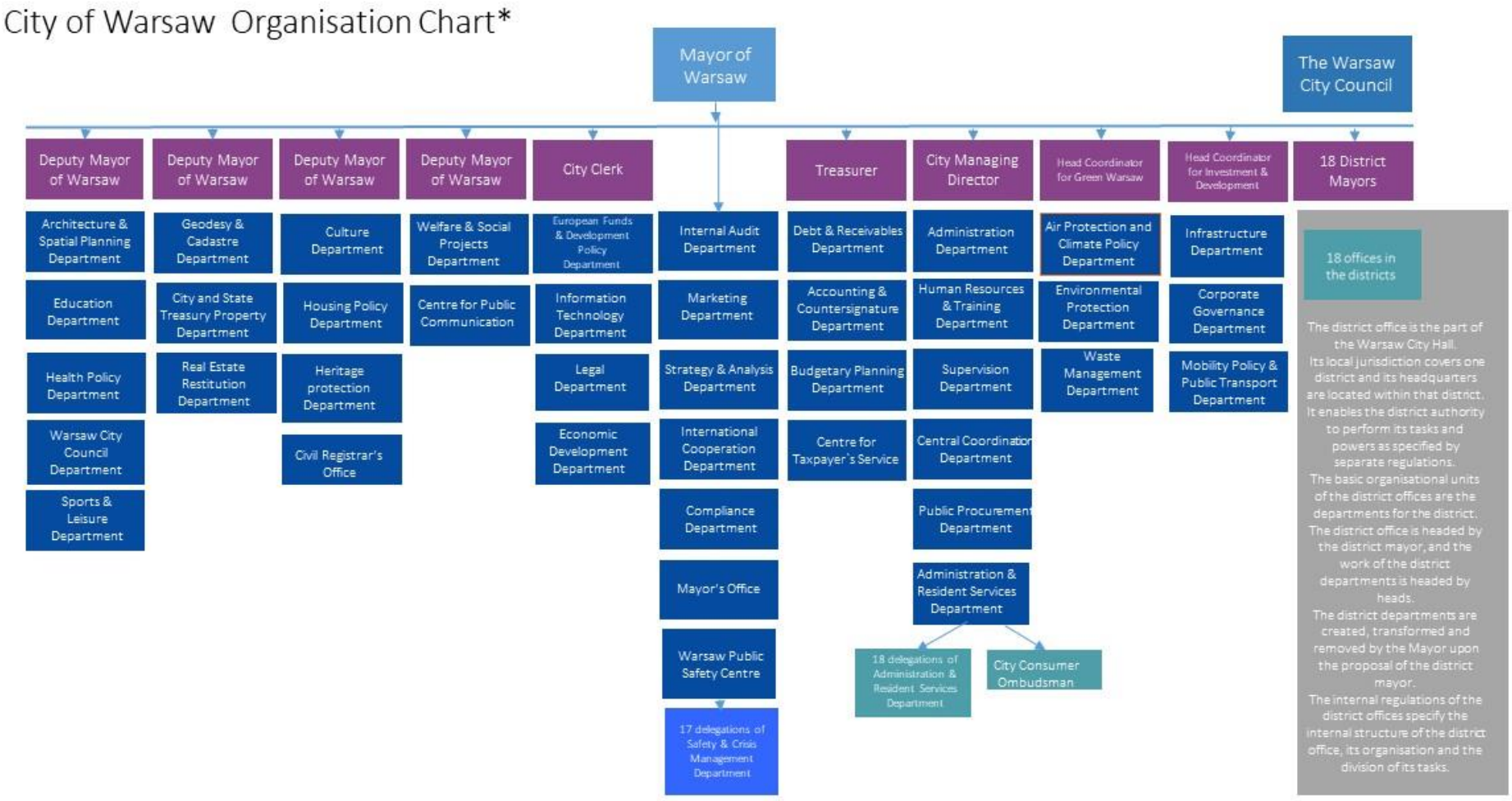


**Figure 7. City of Warsaw Organisation Chart**

NET ZERO CITIES

EU MISSION PLATFORM | CLIMATE NEUTRAL AND SMART CITIES

## Climate Contract

# Commitments to climate neutrality by 2030

## Warsaw's commitments to climate neutrality by 2030

Warsaw

*The content of this document reflects only the author's point of view. The European Commission is not responsible for any use of the information contained therein.*

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# Table of Contents

# 1 Introduction

The conclusions included in the latest - 6th report of the Intergovernmental Panel on Climate Change - IPCC (IPCC AR6 WGI) indicate that there is a high risk that the 2015 Paris Agreement targets of limiting global warming to well below 2°C and ultimately stopping it at 1.5°C, relative to the pre-industrial era, will not be achieved. This means that we have one last chance to stop global warming and that actions aimed at achieving climate neutrality has gained critically urgent and global priority status.
According to the GHG Protocol for Cities. An Accounting and Reporting Standard for Cities, cities account for approx. 70% of greenhouse gas emissions, while at the same time driving the growth of the global economy, producing about 80% of global GDP. They are occupied by approx. 55% of the world's population (World Cities Report 2022) and about 60% of Poles (CSO 2023) and they constitute the largest consumers and sometimes also generators of heat and electricity.
They are the places where most construction takes place (critical infrastructure is being built, among other things), they constitute the centres of industry, business, the recipients of most consumer goods, the places of particularly high concentrations of movements of people and goods, as well as the largest generators of waste.

Climate change is increasingly important in terms of health, the economy, urban infrastructure, and public safety. Cities constitute large population centres, have dense buildings, extensive infrastructure, and depend on external resource supplies, making them particularly vulnerable to the effects of climate change. The urban population is particularly vulnerable to the effects of warming due to the nature of the urbanised environment, which stimulates negative phenomena such as urban heat islands. Therefore, transformational activities concerning both reducing the demand and consumption of resources as well as their efficient use should be accelerated. As Poland's largest city and its administrative capital, Warsaw is aware of its important role in the quest for climate neutrality. The city is inhabited by more than 5% of the country's population (Central Statistical Office, 2022), with its users constituting an additional 1% - which amounts to nearly 2 million people functioning in Warsaw on a daily basis. The largest central offices, institutions, as well as headquarters of many national and international companies and institutions are located here. Therefore, the city has a significant share of national greenhouse gas emissions and, as the capital, a major opinion-forming role.

Therefore, the Capital City of Warsaw wants to play a leading role in the region and in the country in climate actions: to implement, test, and replicate new solutions and set the trends for other cities in Poland and Europe.
Joining the EU Mission "100 climate-neutral and smart cities by 2030" constitutes the following step for Warsaw and a logical consequence of its long-standing climate policy. It consists in bringing existing objectives and plans down to a very specific, operational, local level. It also constitutes an opportunity to obtain substantive and financial support for planned and ongoing operations responding to the increasingly urgent climate challenges – primarly taking into consideration the needs of the city and its residents in this regard. It provides an opportunity to exchange ideas and experiences, a chance to learn from each other, to prototype, test, and modify specific solutions as well as gather experiences that can be replicated and used on a larger scale. However, participating in the EU Mission is primarily an additional incentive to mobilise all possible stakeholders and resources to implemement climate actions This stimulus is particularly important in the context in which Polish cities operate. In Poland, after many years of neglect, a coherent climate policy is only just beginning to be established at a

national level. As a result, the more ambitious cities need to look for additional sources of support and opportunities for their pro-climate measures.

Warsaw has established city-wide climate goals in its key climate policy document, the **Green Vision for Warsaw** (GCCAP). These are a **40% reduction** in greenhouse gas emissions by **2030** and climate **neutrality** by **2050** at the latest.

In joining the **EU Mission** "100 climate-neutral and smart cities by 2030," Warsaw declared by setting a reduction target of **80%** by **2030** for **two selected city districts**. This decision was dictated by awareness of local and systemic opportunities and constraints, as explained in detail later in this document.

## Warsaw's climate policy

Warsaw has been pursuing a consistent climate policy for many years through the following measures:

- 2007 - Warsaw joins the **C40 Cities** association, an organisation bringing together the world's metropolises working together on climate protection. Warsaw is a member of five working groups and a signatory to several agreements and declarations, the implementation of which has had a very positive impact on adaptation and mitigation measures, as well as the quality of life and health of the population.
- 2009 - joining the European Commission initiative **Covenant of Mayors** - 31 August 2021 the Warsaw City Council has adopted Position No. 37 on a new climate declaration as part of the international initiative "Covenant of Mayors for Climate and Energy". It obliges the Capital City of Warsaw to reduce greenhouse gas emissions in accordance with the goal of achieving climate neutrality in 2050, to increase the city's resilience and adaptation to the adverse effects of climate change, and to combat fuel poverty as one of the key actions to ensure a just transition.
- 2009 - Adopting the **Sustainable Urban Mobility Plan (SUMP)** - the first document of a strategic nature that set out the principles for developing urban transport in a sustainable manner (on 16 November 2023 the Warsaw City Council adopted the new Sustainable Urban Mobility Plan for the Warsaw metropolitan area - SUMP).
- 2011 - Adopting the **Sustainable Energy Action Plan (SEAP)** - aimed at reducing the city's energy consumption and carbon dioxide emissions into the atmosphere by, among other things, increasing energy production from renewable sources.
- 2016 - Adopting the **Environmental Protection Programme for the period 2017-2020 with a view to 2023** (updated in 2021. A new programme up to 2030 is currently under development), indicating actions aimed at improving the quality of life in the city through sustainable development, preserving the significant values of the natural environment, improving its condition, improving spatial order, and developing environmental infrastructure (equipment, systems, as well as activities aimed at protecting and improving the environment), protecting the climate, and adapting the city to its changes.
- 2018 - Adopting the **#Warsaw 2030 Development Strategy -** a general document that defines the city's vision, strategic and operational goals. Works on updating the document, including making climate issues (mitigation and adaptation) a higher priority in the city's strategic goals, is currently underway.

- 2019 - Adopting the **Climate Change Adaptation Strategy for the Capital City of Warsaw by 2030 with a perspective to 2050. Municipal Adaptation Plan** (Resolution No. XV/339/2019 of the Warsaw City Council of 4 July 2019), constituting the policy of the Capital City of Warsaw in terms of taking action to prevent and mitigate the negative effects of climate change. The document describes the key threats resulting from climate change and the associated risk areas for Warsaw and its residents, as well as indicates the courses of action through which the City will protect itself against the negative effects of climate change-related phenomena.
- 2019 - Establishing the **Air Protection and Climate Policy Department (BOPiPK)** with the task of, inter alia, coordinating the city's climate policy, initiating activities and processes regarding mitigating and adapting to climate change.
- 2020 - carrying out a citizens' panel called: the **Warsaw Climate Panel.** The aim of the panel was to enable the citizens of Warsaw to participate in the decision-making process concerning increasing the energy efficiency of Warsaw and the share of renewable energy sources in the city's energy balance. A group of randomly selected 90 residents, representative for the city's social structure in terms of age, gender and education, came up with 49 recommendations, which are being implemented by Warsaw on the basis of the Mayor's commitment.
- 2023 – adopting the **Green Vision for Warsaw (GCCAP)** (resolution No. LXXX/2648/2023 of the Warsaw City Council of 20 April 2023) - a document describing how the city can achieve climate neutrality by 2050. It is a comprehensive Green City & Climate Action Plan. It is based on the city's declared levels of greenhouse gas reductions and pledge to aim for climate neutrality. The GCCAP works in favour of achieving sustainable development goals while promoting social inclusion.
- 2022 - an application to the Pilot Cities Programme in terms of the EU 100 Cities Mission, receiving a grant and joining **the consortium of the project NEEST - Climate Neutral and Environmentally Sustainable Urban Areas** (Resolution of the Warsaw City Council No. LXXXVI/2839/2023 of 31 August 2023 on undertaking cooperation between the Capital City of Warsaw with the following cities: Kraków, Łódź, Rzeszów, and Wrocław in implementing the project)
- 2023 - the beginning of work on the **General Plan**, which, due to legislative changes in Poland will replace the existing **Study of Conditions and Directions for Spatial Development of Warsaw** - the main planning document defining the land use policy for the entire city area. The documents determining the city's spatial policy have a significant impact on the implementation of climate goals.
- 2023 - establishing the **Climate Team chaired by the Mayor of the City of Warsaw** - an interdisciplinary team composed of heads of units of the City of Warsaw and representatives of other municipal entities with the greatest impact on implementing the city's climate policy. The task of the team is to coordinate the implementation of projects and processes in the area of mitigation and adaptation, which are systemic and interdisciplinary in nature.
- 2023 - accessing the European Bank for Reconstruction and Development project: **Enhancing City-level Climate Governance: Implementation Plan and Initial Climate Risk Disclosure for the City of Warsaw**, which aims to build awareness and competence in the city' departments and organisational units regarding a better understanding of climate change risks and potential opportunities, to help develop climate proofing processes for city investments and to support the

identification of an effective governance model to integrate climate issues into key city management and planning processes (climate governance).

- Since 2007 as part of the Covenant of Mayors (SEAP), Warsaw has been carrying out **a GHG inventory** in 2-year cycles. As of 2018, the inventory is carried out in accordance with the requirements of the "GHG Protocol Corporate Accounting and Reporting Standard". The most recent inventory was carried out in 2023 and includes data concerning 2022 emissions.

## Documents outlining the climate policy

The Capital City of Warsaw currently includes three main documents outlining the climate and sustainable development policy:

1. The **Green Vision for Warsaw (GCCAP - Green Cities and Climate Action Plan)** - a "roadmap" containing the city's reduction targets and a description of measures for achieving them, as well as an action plan for a sustainable city.

2. **Climate Change Adaptation Strategy for the Capital City of Warsaw by 2030 with a perspective to 2050. Municipal Adaptation Plan** - a document defining the city's policy to prepare and adapt Warsaw to ongoing climate change and support building the resilience of the city's residents to its effects, with acceptable economic, social and natural costs..

3. **Environmental Protection Programme** - an executive document for the #Warsaw 2030 Strategy (relating to operational objective: 3.2. We live in a clean natural environment), containing a diagnosis of the environment's state, main objective, performance areas, specific objectives, areas of intervention and targets that the city must take to protect the environment (its quality, functions), including climate protection.

The most comprehensive document describing climate policy goals and actions for achieving them is the **Green Vision for Warsaw (GCCAP)**.

It combines two methodologies used around the world: the Green City Action Plan, developed by the European Bank for Reconstruction and Development, and the Climate Action Plan, developed by the C40 Cities Climate Leadership Group. Combining these two methodologies allowed producing a document that is comprehensively based on verified data.
Creating the GCCAP was preceded by a thorough analysis of the state of the city (based on 122 indicators) in terms of the pressures exerted by various areas of the city's functioning on the environment and climate, the state of the natural environment and the city's responses to environmental and climate risks to date.

The document establishes the climate objectives of the Capital City of Warsaw: a **40% reduction in greenhouse gas emissions by 2030** and **climate neutrality by 2050 at the latest.** It includes:

- Results of analysing the state of the city including identifying the most vulnerable and endangered areas.
- A description of the 3 action scenarios and their consequences: a business-as-usual scenario, a reduction scenario (which we want to follow), and an extended scenario (assuming more ambitious climate targets possible in case of favourable external factors).
- Long-term targets, indicating specific areas requiring action with a cut-off date for achieving the main reduction target, and short-term targets.

- 27 specific actions allowing to achieve short- and long-term goals, in the following areas: energy infrastructure, buildings, urban planning and blue-green infrastructure, transport, municipal waste, building social capital, and integration.
- A description of the existing and potential challenges and barriers to achieving the stated objectives.
- Estimated costs of activities (CAPEX and OPEX) as well as possible sources of funding.

The next natural step towards achieving climate neutrality is to **participate in the European Commission's Mission of 100 Climate Neutral and Smart Cities by 2030, which will allow Warsaw** to:

- speed-up operations in favour of climate-neutrality in two selected city districts and test solutions allowing to determine which are most effective and whether more ambitious citywide climate targets are feasible,
- develop and promote systemic innovations in implementing urban investments towards climate neutrality,
- mobilise the city's resources, those of the municipality and, above all, those in private hands, around ambitious climate goals and to gain experience in this area that can be implemented throughout the city. Mobilising stakeholders will also raise their awareness concerning the climate crisis, help to build a sense of shared responsibility for decarbonising and adapting the city in them,
- gain substantive support and facilitate access to financial support for transformational activities.

### The Climate City Contract as an acceleration of the Green Vision for Warsaw (GCCAP) for two districts that constitute laboratories for change.

We perceive participating in the EC Mission primarily as an opportunity to bring the city-wide goals and actions contained in the Green Vision for Warsaw to the local and maximally operationalised level. It will be valuable to learn lessons from their implementation for the city as a whole in order to implement the extended scenario described therein, as well as to adopt new, even more ambitious assumptions and develop innovative activities by 2030. Implementing the Climate City Contract with its ambitious reduction target for two large districts of Warsaw will also constitute a significant contribution in terms of reducing greenhouse gases on a city-wide scale.

Therefore, we are treating the CCC as an action aimed at accelerating and intensifying the implementation of the Green Vision for Warsaw (GCCAP) for the two districts that constitute urban laboratories for change, for which the proposed actions will achieve a reduction in line with the Mission's targets of 80% or the base year.

# 2 Goal: Climate neutrality by 2030

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Warsaw has pledged to achieve climate neutrality by 2050 at the latest and this is a priority expressed in City Council Position No. 37 of 31 August 2021. However, in the face of the worsening climate crisis

and its effects being experienced more and more strongly in cities, accelerating decarbonisation measures is essential for the continued sustainability, safety, health, and functioning of residents and urban infrastructure.

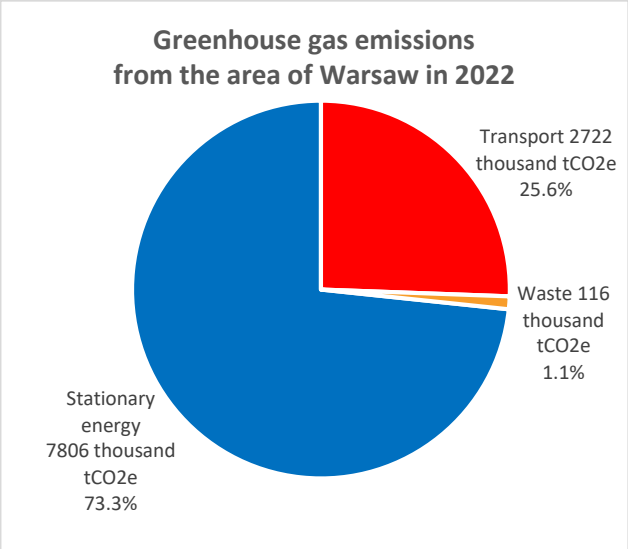
The key document for the city, **the Green Vision for Warsaw (GCAAP)**, identifies 3 climate scenarios for the entire city:

1. **A business-as-usual scenario**, taking into account the "no additional climate action" emissions projection, which is a scenario that serves as a baseline and comparison for the planned actions.
2. **Reduction scenario**, which defines long-term, achievable goals to achieve the Climate Action Plan (CAP). At the same time, they are linked to the short-term goals of the Green City Action Plan (GCAP), covering a 10-15 year time perspective.

   This scenario assumes a **40% reduction in greenhouse gas emissions by 2030** as an interim target (compared to 2007, equivalent to a 35% reduction compared to 2018) and **climate neutrality in 2050**.
3. **An extended scenario**, which is potentially possible to be implemented in the city if two conditions are met: the city will operate in favourable political conditions (Poland's climate policy will be developed, enabling Warsaw to meet its ambitious climate targets) and the city will receive sufficient financial resources (national and European) to implement pro-climate measures. This scenario assumes a **60% reduction in greenhouse gas emissions by 2030** as an interim target (compared to 2007, equivalent to 50% compared to 2018).

The applicable scenario for the entire city is the **reduction scenario**. The level of the reduction target that has been set in terms of it is based on the following considerations:

- The greenhouse gas inventory for Warsaw, for the years 2018, 2020, 2022, shows that almost three quarters of the city's emissions arise from the production of energy (electricity and heat) and its consumption by buildings.
- The city has a highly limited impact on the sources of energy generation, which are regulated at national level. There are two energy companies within the city, which supply 80% of the city's heating needs, are independent of the city and are not obliged to consult their development plans with the local authority. The current domestic energy mix is based on fossil fuels. The main fuel is coal. For example, in 2022, 66.2% of the country's heat production came from coal and almost 16% from other fossil fuels: natural gas and fuel oil (Energy Regulatory Office - Report: Thermal power industry in numbers - 2022),
- The results of the greenhouse gas inventory in Warsaw, for the years 2018, 2020, 2022, show that the share of municipal units in the emissions of the entire City of Warsaw oscillated around 7.5% (concerns the 1 and 2 emission range).




*Nearly three quarters of Warsaw's greenhouse gas emissions result from the production and consumption of electricity and heat by buildings.*

*A quarter of the emissions are related to transport - primarily road and to a lesser extent rail, water, and air.*

*Approximately one% of emissions result from the treatment of waste generated within the city.*

The above information shows that in terms of its climate neutrality efforts, including the pace of transition away from fossil energy sources at the national level, Warsaw is to a great degree dependent on external factors and the actions of the private sector and non-local government institutions.

Warsaw, despite its ambitious aspirations, has to face existing limitations, which is why the application for acceptance to the City Mission included a selected area of the city - two districts, Praga-Południe and Ursynów, for which greenhouse gas emission reduction targets of **80% by 2030** have been declared. Such an ambitious goal, very difficult to achieve on a city-wide scale, is possible on a more limited scale. Focusing on two districts and the smaller scale of activities will facilitate the involvement of shareholders, that are external to the City of Warsaw, to become involved in implementing the adopted objective (due to the smaller scale of activities) and to develop cooperation paths, which will help to create a city-wide cooperation system at a later stage.

The decision to identify two selected areas of the capital, the districts of Praga-Południe and Ursynów, was made because of their diversity and potential in terms of development structure, transport infrastructure, blue-green infrastructure areas, industrial and service development, as well as power grid characteristics. Moreover, they include a very similar emission structure in relation to that of the entire city, making them representative for Warsaw as a whole in this respect. Their location was also important due to their setting within the urban fabric in dense, relatively old buildings, as well as near the Vistula Rive (Praga-Południe) and on the outskirts of the city (Ursynów) with fairly modern, mainly residential and also large volume buildings, as well as the end of the metro line and a large area of greenery (the Kabacki Forest nature reserve) surrounding part of the district. Thanks to this, Warsaw has the opportunity to develop diverse innovative solutions in response to the various threats posed by the growing climate crisis, which can be replicated across the city. Other reasons for making this choice included the good cooperation with the districts to date, their commitment to climate-neutral activities and their awareness of their importance in the quest for climate neutrality and improving the lives of local people.

The idea behind preparing the CCC for the two Districts was to create so-called **local centres** (city labs) of **climate transformation**, progressive areas of the city to test the feasibility of implementing the solutions required to achieve climate neutrality in 2030 across the city.


Irrespective of the plans and actions developed in the Climate City Contract for the designated area of the two districts of Praga-Południe and Ursynów, work towards climate neutrality in the 2050 perspective will be carried out in parallel across all of Warsaw, in accordance with the goals and directions currently outlined in the Green Vision for Warsaw. At the same time, successful solutions, action paths, innovations and synergies developed for the districts covered by the Climate City Contract will be analysed on an ongoing basis for applicability in other districts of Warsaw in order to intensify operations concerning decarbonisation. The cooperation developed between the city's internal units, the relationships established with stakeholders, the good cooperation practices in the urban environment, will already be tested and ready to be implemented elsewhere.

### Additional benefits associated with adopting the Climate City Contract

In addition to the previously mentioned benefits of adopting an ambitious target for the districts submitted to the EU Mission, the districts, and consequently the entire city, will benefit as a result of intensified climate action:

- increasing the city's energy independence in the face of an uncertain geopolitical situation through becoming independent from fossil fuels and increased national, regional and local energy sources,
- increasing energy security through dispersing energy sources,
- reducing the city's operating costs, through increased energy efficiency and an increased number of own as well as diversified energy sources,
- reducing energy costs for residents by increasing energy efficiency and developing a prosumer model of energy generation,

- increasing the awareness and involvement of residents in pro-climate transformation and operation in favour of the city, building co-responsibility for the city,
- improving the quality of life and health for residents resulting from reduced air pollution and reduced levels of ambient noise, light pollution,
- improving the quality and aesthetics of the urban space and making it more attractive,
- increasing the city's resilience to the effects of climate change, through increased biodiversity, and expanding blue-green infrastructure,
- an impulse for sustainable economic development thanks to developing new sectors working for the climate and energy transition and an increase in the economic competitiveness of the city,
- creating new "green" jobs,
- an impulse for scientific development and the formation of innovation,
- greater social inclusion through the involvement and cooperation of various stakeholders,
- developing and testing tools for reducing energy poverty, including by being able to resell green electricity or heat produced by the city on preferential terms to people in a difficult material situation and by reducing energy demand through energy efficiency improvements in buildings,
- increasing the quality of life of residents, the level of health, as well as the tourist attractiveness of Warsaw and the surrounding area by expanding and diversifying the urban ecosystem and creating friendly places for recreation and relaxation,
- increasing the area and ensuring the protection of nature-rich areas, increasing biodiversity and improving access to nature-rich areas for residents,
- improving the convenience of connections and accessibility of public transport and cycling, as well as improving safety for pedestrians and cyclists,
- less traffic, less road congestion due to a reduction in the proportion of individual transport on the road, increased use of public transport, and the implementation of the idea of 15-minute districts and communities,
- increasing social inclusion and stimulating sustainable economic development by creating spaces with less traffic that can constitute local centres of community life,
- reducing the amount of waste sent to landfill as well as improving local waste management and recycling rates.

Due to the fact that there are no large-scale ETS facilities within the administrative boundaries of the districts covered by the Climate City Contract, all facilities in their area are included in the reduction target.

# 3 Strategic priorities

In setting the strategic priorities, we relied on **the results of** the **GHG inventory** for Warsaw and **the predictions of the economic model** (an integrated tool for supporting the climate transition planning process, enabling data-driven strategic decision-making). We've placed emphasis on measures that will have the most measurable effect in terms of rapid $CO_2$ reduction.

The following priorities concern implementing the Climate City Contract for the Ursynów and Praga Południe Districts. While they are based on the assumptions of the Green Vision for Warsaw (GCCAP), they take into account local specificities.

According to the results of the latest GHG inventory (for 2022), Warsaw's dominant sector, in terms of emissions, consists in stationary energy (electricity and heat production and consumption by buildings), which accounts for 73% of the city's total emissions. Another key sector is transport, which accounts for 26% of Warsaw's emissions.

The above findings result in strategic, systemic priorities for the mission districts to achieve the 2030 reduction target. These are:

### System priority 1: changing the structure of energy sources - replacing fossil energy sources in the area of electricity and heat production and distribution with low-carbon/ renewable sources.

Key measures for drastically reducing greenhouse gas emissions and achieving climate neutrality include a change in the energy mix concerning the sources of electricity and heat used in the Warsaw districts covered by the Climate City Contract.

One of the key elements of the priority consists in, as described in the Green Vision for Warsaw, a strategic partnership with the energy sector (energy distributors and producers) in terms of implementing strategies for achieving climate neutrality in areas such as: increasing energy production from non-fossil sources (e.g. biogas), modernising energy networks allowing optimum use of energy produced by prosumers, using waste energy, energy storage, increasing the offer of sales concerning certified green energy, green energy, searching for new energy supply sources (e.g hydrogen energy, geothermal energy). An important element of the priority will also be to increase the efficiency and synergy of activities through the implementation of integrated projects, combining the above elements (energy production from RES + energy storage (electricity/heat/cooling)+energy management systems, etc.).

Another element of the priority is to continue and intensify investments in RES in city-owned buildings and in municipal companies within the districts covered by the Climate City Contract (with due regard for the protection of historic buildings). The Urban Photovoltaic Development Programme, created in 2022, will be used for this. The city will continue its efforts to decarbonise city companies (Metro Warszawskie - en. Warsaw Metro, Miejskie Zakłady Autobusowe – en. Municipal Bus Company, Tramwaje Warszawskie – en. Warsaw Trams, Miejskie Przedsiębiorstwo Oczyszczania – en. Municipal Cleaning Company, Miejskie Przedsiębiorstwo Wodociągów i Kanalizacji – en. Municipal Water and Sewerage)

Company) by using owned properties for RES investments (solar energy, wind energy, biogas plants). The city will also continue its financial support for residents (grants for renewable energy sources in private properties and those belonging to housing associations and cooperatives) as well as substantive support in the form of a free energy advisory scheme that has been in place since 2021.

Another element for implementing the priority will consist in cooperation with stakeholders: businesses and institutions not related to local government, in the form of agreements for decarbonisation measures (including incorporating such measures into the ESG strategy of businesses) as well as promotional and educational activities.

The key stakeholders in implementing this priority are:

- state-owned energy companies - energy producers. The rate of decarbonising the entire city depends, to a large extent, on the rate of decarbonising the CHP plants supplying the city with energy, including the most carbon-intensive building sector.
- energy distributors - Warsaw's power grid is outdated and requires modernisation. It also requires investment in modern energy transmission management systems and energy storage. The profitability of investing in renewable energy sources in the city depends, to a large extent, on the absorption capacity of the grid.
- the government of the Republic of Poland and relevant ministries - the main shareholder of energy companies is the Government of the Republic of Poland, which has an impact on their operations strategy and also the national decarbonisation policy. Moreover, legislative initiatives for more favourable settlements with prosumers for the electricity they supplied into the grid, or regulations allowing establishing energy cooperatives in cities, are needed to develop RES and the prosumer energy market.

### System priority 2: Reducing the demand for heat and electricity from fossil sources.

The system priority will be implemented mainly by increasing the energy efficiency of buildings. It assumes primarily the thermal modernisation of the municipal stock of residential and commercial buildings, as well as the thermal modernisation of private, cooperative buildings as well as those belonging to enterprises and institutions not associated with the local authority (with due regard for the protection of historic buildings). Therefore, in the next 3-5 years, the city will focus on carrying out modernisations of its own buildings to increase their energy efficiency and on creating incentives and support systems for private building owners to take such measures.

Currently, in terms of preparatory projects involving the preparation of analyses, the typing of buildings, developing modernisation models (NEEST project) as well as projects related to the preparation and implementation of thermomodernization investments for municipal buildings (ELENA project), the city is preparing to scale up thermal modernisation measures for city buildings.

Another element of implementing the priority consists in a system of free energy consulting for residents concerning technical issues and the use of municipal, regional, and national funding programmes.

Implementing the priority will be supported by the Warsaw Green Building Standard, which sets out requirements concerning urban buildings in terms of sustainable construction, including energy efficiency, and the Energy Management System being introduced in the city's buildings, which monitors electrical, heating, ventilation, and environmental parameters, optimising energy

consumption. Similar solutions will be promoted to private building owners, entrepreneurs, and developers, with whom agreements will be established to cooperate in this scope.

Other measures, in terms of implementing the priority, consist in continuing the modernisation of the city's outdoor lighting through the use of LED luminaires, which will reduce energy consumption by 40%, as well as recovering and using waste heat from production processes, cooling systems, server rooms, subways, wastewater, and other sources in the districts covered by the Climate City Contract.

In implementing this priority, the main stakeholders are:

- the Government of the Republic of Poland, the National Fund for Environmental Protection and Water Management, and other operators of funding programmes - the deep thermo-modernisation of buildings involves great costs (for own investments or financial support for residents), hence the key role here is to ensure adequate funding for local authorities from external sources,
- science sector - reducing the demand for primary energy requires constantly searching for and implementing innovative solutions in the form of: ways to reduce consumption, energy recovery methods, ways to use waste energy, efficient storage, of surplus energy,
- municipal companies as well as manufacturing, commercial, and service companies - these are entities consuming great amounts of energy and having a high potential for reducing consumption and using waste energy,
- construction and renovation companies, as well as housing associations and cooperatives - building operators and building administrators have a huge impact on developing and implementing new energy standards in new and renovated buildings. Without commitment on their part, it will be difficult to carry out effective activities in this area,
- residents, especially in the area of maintaining the principles of a fair energy transition and protecting vulnerable groups.

### System priority 3: Development and promotion of sustainable transport

Transport constitutes the second largest source of greenhouse gas emissions in Warsaw, after stationary energy, accounting for 25.6% of all emissions and a major source of air pollution. These emissions are mainly generated by road transport, with individual car transport accounting for the largest share. Therefore, the key actions concerning priority 3 focus on developing low-carbon alternative modes of urban travel, which will become an attractive (comfortable, accessible, safe) alternative for a large proportion of people travelling around the city using individual car transport.

Warsaw is steadily increasing the level of electrifying public transport. There are currently more than 160 electric buses, 70 hybrid buses, and 418 gas-powered buses operating in Warsaw. In 2023, the Public Transport Authority signed a contract for the purchase of additional 12 electric buses. This trend will continue, with an increased number of lines served by electric buses in the mission districts. The city is also testing hydrogen-powered buses.
The Green Vision for Warsaw includes the "Further development of urban integrated rail transport" (Polish: Dalszy rozwój miejskiego zintegrowanego transportu szynowego) operation, as part of which an intensive expansion of the tramway network, which is now 134 km long, and the extension of the Fast Urban Rail network are taking place. The aim of the operation consists in increasing the number of people travelling by public transport, decreasing the number of private cars travelling through the

city, and reducing the average journey time by rail transport from the suburbs to the city centre. Further development of existing and construction of new subway lines is also planned.

In 2023, the number of public transport passengers exceeded 955 million, compared to 863 million the year before. This is an increase of almost 100 million. Buses carried the most passengers (the bus network is the largest) with more than 450 million, and the metro had the highest increase of passengers with more than 40 million compared to 2022.

Reducing the scale of individual car transport will also be facilitated by a systematic improvement in the comfort and safety of public transport travel thanks to purchasing new rolling stock, modernising and creating new P+R car parks, increasing the number of safe and accessible stops, developing environmentally friendly (green tracks and green stops) transport infrastructure, measures to increase passenger comfort in transport waiting areas, dosing traffic by means of a traffic control system and by changing the cross-section of the roadways, as well as o the introduction of priority for public transport (priority in traffic lights, the traffic lights, separation of bus lanes).
Other measures in favour of carrying out the priority include systematically expanding the bicycle infrastructure (the bicycle network in the capital city already has 773.4 km of routes), developing the Veturilo system, which is one of the largest urban bicycle systems in Europe, expanding paid parking zones, creating the Clean Transport Zone, expanding pedestrian infrastructure (by modernising and greening streets, widening pavements, creating safe pedestrian crossings, reducing traffic), educational campaigns. These activities will be particularly intensified in the districts covered by the Climate City Contract.

Support for the development of electromobility is an another element aimed at reducing emissions from individual car transport.  Developing electromobility will consist in the form of investing, together with private partners, in appropriate infrastructure, expanding the network of charging stations for electric vehicles, promoting Car-sharing and other forms of vehicle sharing

In this case, the main stakeholders include:

- the Government of the Republic of Poland, the National Fund for Environmental Protection and Water Management, and other operators of funding programmes - investments in public transport are costly, so securing adequate funding for local authorities from external sources plays a key role in this regard. Whereas, the development of electromobility requires support through, for example, proper tax breaks or subsidies for purchasing electric vehicles,
- companies - operators of vehicle charging stations so that a proper infrastructure can be developed and maintained to encourage the purchase and use of electric vehicles,
- municipal companies - responsible for developing pedestrian and bicycle infrastructure, as well as the public transport network,
- residents - the issues of reducing car traffic and changing transport habits are socially important topics, and therefore the residents of the areas affected by the changes will be involved in each consultation process concerning specific solutions.

### System priority 4: Developing blue-green infrastructure

Warsaw is a city with a very high proportion of greenery - the ratio of open green areas (understood as parks, public and residential green areas, as well as protected areas) per 100,000 residents is high, and urban forests alone account for approx. 15% of the city's area. However, these areas need to be protected against excessive urbanisation pressures, re-naturalised, enhanced in terms of providing ecosystem services, as well as increasing the area of biologically active surface where this is possible and most needed. As part of protecting the blue-green infrastructure, the city will, inter alia, through Local Spatial Development Plans, impact the density of urban development in such a way as to protect areas of natural value and to ensure the sustainability of development (Warsaw has a relatively low density of development, but is threatened by excessive horizontal building development). Measures concerning densification will affect the Ursynów district to a greater extent, as Praga Południe is the district with the highest population density in Warsaw.
Maintaining and developing the blue-green infrastructure is very important both in terms of sequestering excess carbon, as well as adaptation measures for increasing the city's resilience to the effects of climate change and increasing access for residents to recreational areas.

The planned activities include: securing natural areas not covered by protection (without legal forms of nature protection or local plans) from further urbanisation pressure (which will help ensure the protection of environmentally valuable areas, such as elements of the hydrographic system with a biological enclosure like Zgorzała Lake in Ursynów, or Gocławskie and Balaton lakes, as well as Wystawowy and Gocławskie canals in South Praga), planting trees and shrubs, increasing biologically active areas and unsealing impermeable surfaces, expanding small retention facilities, water reservoir revitalization.

These activities will be implemented both through direct city investments such as the continuation of the modernisation and greening of streets programme, tree planting as part of the existing Million Trees for Warsaw programme (in which residents suggest planting sites using an app), the green track programme and other activities. District and citywide programmes for removing concrete from backyards and squares will also be continued and developed. Supporting measures consist of implementing and enforcing greenery management standards (standard for information on cuttings, standard for protecting greenery in investment processes, standard for tree care and pruning, standard for dendrological reviews and analyses).

The city will also encourage residents, cooperatives, housing communities, and businesses to remove concrete surfaces, plant greenery, and set up small-scale retention facilities on land owned by them, through education (e.g. Warsaw Climate Change Adaptation Guidebook) and support programmes - expert advice from municipal entities and grant programmes for small-scale retention facilities, as well as the civic budget.

These activities will be similar for both mission districts, but with a different distribution of emphasis due to their specificities. The peripheral Ursynów District includes large areas of green space (including the vast Kabacki Forest), so the emphasis here will be on protecting and expanding green spaces. On the other hand, the Praga Południe District is a central district with more dense development, where the priority will be to increase the biologically active area, e.g. by removing concrete surfaces and installing small retention facilities.

The key stakeholders for Priority 4 are:

- municipal entities and companies and district offices, which are land administrators,

- the Greenery Management Board of the City of Warsaw - with regard to investments concerning blue-green infrastructure in the areas subordinate to the unit as well as establishing and enforcing greenery management standards,
- cooperatives, administrators of buildings and undeveloped land, housing communities,
- companies and institutions possessing property in the mission districts,
- universities and research institutions in terms of finding new solutions concerning developing blue-green infrastructure,
- residents who must be consulted in terms of how public land is developed.

For all the above-mentioned priorities, the residents of the districts implementing the CCC and representatives of civil society (NGOs, urban movements, associations) constitute very important stakeholders, as implementing the measures described will have a huge impact on their lives (financial resources, comfort of living and moving around the city, or lifestyle). They can also have a strong impact on other stakeholders, e.g. as members of housing associations or cooperatives and on developers as customers. We will continue to develop cooperation with residents and NGOs, supporting them in changing their energy consumption behaviour, modernising their housing stock and transport habits.

# 4 Process and principles

The City of Warsaw treats the EU's mission of "100 climate-neutral and smart cities by 2030" as a key element of its climate policy, as well as an opportunity to rank it higher rank in the city's hierarchy of priorities.

The city has been implementing decarbonisation and sustainability measures for many years. However, for a long time these were grassroots activities, carried out by cells, units, and municipal companies without systemic coordination. As a result, municipal resources and provided funds have not been optimally utilised due to a lack of synergy and systemic planning.
The plans and programmes emerging in the city were sectoral, because in the city's main strategy #Warsaw2030, the climate objective was not one of the main objectives. As a first step towards synchronising and optimising all city activities in a systemic way, the **Green Vision for Warsaw (GCCAP)** was developed, a document preceded by an analysis of the state of the city, based on data, bringing together the city's most important measures for sustainable development and climate neutrality and describing them in a way that facilitates implementing (specific objectives and actions, schedule) and indicates how progress is to be monitored (indicators and monitoring system). The following step consisted of establishing the **Climate Team**, which coordinates climate policy in the city across the substantive "silos" of the City Hall. The city is also preparing for the **evaluation of the Adaptation Strategy** in 2024, with the aim of linking mitigation and adaptation measures systemically, including by creating a single monitoring and evaluation system for all climate policy issues. The city includes also a number of interdisciplinary groups and working teams dealing with specific projects or processes that go beyond the responsibility of individual units.

Undertaking the Mission and implementing the Climate City Contract will allow, independently of the city-wide measures described in the Green Vision for Warsaw, not only accelerating the

decarbonisation measures within the two districts, but also entering into an even higher level of planning, synchronisation and inclusiveness in implementing the city's climate goals. The smaller scale of the action (two districts, not the entire city), will allow to develop, in a safe way - on the principle of urban laboratories - cooperation mechanisms and ways of action, which can be applied in other districts.

In the process of implementing the CCC, we want to build on our previous good experiences, adding to them the experience and knowledge we have gained in the course of implementing the activities: from our project partners, advisors, other cities, stakeholders, etc.

We also want to extend the involvement of stakeholders and residents in the entire process - to make them feel even more like hosts of the city, co-responsible for its shape and functioning in the future. We will also support them in this process in the course of cooperation with external stakeholders.

In this regard we will take advantage of our extensive experience from past participatory and consultative processes. Warsaw has been involving residents and stakeholders in important decision-making processes for many years through:

- Consulting residents and stakeholders on key plans and actions. Since 2010, 2353 public consultations have taken place in Warsaw.
- Current information about them can be found on a dedicated website (https://konsultacje.um.warszawa.pl)
- extensive consultations with citizens and other stakeholders concerning documents programming the city's development and important projects affecting quality of life, such as: the Climate Change Adaptation Strategy for the City of Warsaw. Warsaw by 2030 with a perspective to 2050. The Municipal Adaptation Plan, Warsaw Spatial Planning Study, Clean Transport Zone, revitalisation programmes, Local Development Plans, etc.
- Participation in developing the Green Vision for Warsaw (GCCAP). We've invited a wide range of stakeholders who had a significant impact on the final character of the document: representatives of NGOs, science, and businesses. Experts from various fields and residents of the capital were also involved in the work. More than 20 working meetings and workshops for external stakeholders took place, as well as dozens of sessions for internal stakeholders - municipal units and units responsible for implementing individual measures. Approx. 300 people participated in them. Residents of Warsaw had also the opportunity to submit their comments on the document via a virtual platform.
- From 2020 to 2021, Warsaw organised the Warsaw Climate Panel, which was entrusted to non-governmental organisations selected in a competition, with 90 residents selected at random to decide on climate policy in the area of increasing Warsaw's energy efficiency and the share of renewable energy sources in the city's energy balance. The panel also included experts, representatives of NGOs and urban movements. Implementing the Panel's provisions is monitored by the Monitoring Team, which includes the social side.
- For more than 10 years, Warsaw has includes the institution of the Citizen's Budget, a process in which the citizens of Warsaw decide what to spend part of the city budget on. They submit their ideas and then, in the way of voting, select those to be implemented by the Warsaw City Council.

- For many years, the city has had a platform called Partnership for Climate, which brings together organisations and institutions representing a wide variety of backgrounds, including state and local government units, embassies, businesses, NGOs, and institutions committed to nature conservation and building a sustainable city. Members of the platform share knowledge, experiences, and carry out joint projects.

The **PRINCIPLES** we wish to follow in implementing the CCC are as follows:


### A strong mandate and cooperation

In order to effectively implement the planned operations, they must include multi-level support and strong legitimacy. Therefore, the Climate City Contract, its implementation method, as well as the measures it stipulates will be subject to a consultation process not only at the preparation stage, but also during the stage of implementation and adjustments made under the influence of experience. The legitimacy must be multi-level: City Management, the Climate Team, the units, cells, and municipal companies involved in the implementation, a wide range of municipal stakeholders (entrepreneurs, academia, residents, institutions, organisations, associations, and urban movements, residents of mission districts), mission district councils and boards, representatives of the government and elected central offices. For this, we provide for a multi-stage arrangements process, depending on the subject matter and scope of the topic. Cooperation is also embedded in the multi-level management of the process.

### Compatibility and coherence

Actions implemented as part of the Climate Contract must be coherent with the strategic objectives and documents programming the city's development as well as other documents that define the

city's development policy, in particular the Green Vision for Warsaw. This will allow using the capital's resources optimally to achieve the CCC's goal and finding synergies in the city's activities in such a way that they support each other. Therefore, the Urban Climate Contact is perceived as a continuation of the activities described in the Green Vision for Warsaw: in a more detailed form, with more ambitious goals, but limited in scope to two districts. Compatibility will be ensured through a process of multi-level collaboration, both within the office and with municipal stakeholders and representatives from government and central offices. The implementation process also provides for an evaluation of selected municipal documents in terms of their compliance with the Climate City Contract.

**Transparency**

Plans, activities, and process management must be public and knowledge concerning them easily accessible. Therefore, a website will be created for the CCC, where the content of the contract, reports from Transition Team meetings, monitoring results or activity reports, as well as other information about the process can be viewed. Residents will also be able to submit their needs and ideas, via the site. Apart from that, regular information meetings will be organised in the district taking part in the CCC, where urban stakeholders will be able to ask questions or make their requests and comments on the process. The results of Transition Team meetings will also be public, with reports published. The city's Public Consultation digital platform (https://konsultacje.um.warszawa.pl/) will be used for public consultation concerning climate contract measures.

**Continuous improvement**

The Climate City Contract is an iterative process - a process of continuous prototyping. Therefore, a mechanism for permanent feedback concerning its progress and effects, as well as a process of monitoring based on concrete, measurable indicators, is crucial in it. The process must include frequent monitoring (twice a year) and evaluation, arrangements for ongoing feedback and knowledge of new solutions and innovations emerging on the market. Discussing the results of monitoring must always be concluded with conclusions and recommendations concerning the modification of the process with a view to improving it and making it more effective.

## PROCESS DESCRIPTION

The city cannot achieve the targets set in the CCC on its own, given that its units are only directly responsible for 7.5% of emissions. Achieving the 80% reduction target in the selected neighbourhoods will only be possible with the involvement of a wide range of stakeholders and gaining broad public acceptance, and that is why the implementation process involves the active participation of stakeholders at many levels. This process is based on bodies that already exist (Climate Team, Transition Team) or are currently being constituted (National Cooperation Platform). The activities carried out within the CCC will be coordinated by the Air Protection and Climate Policy Department, a unit established in the City of Warsaw to initiate and coordinate operations in favour of the climate.

Elements of multi-level process management:

**An Internal Transition Team**, made up of city officials, employees of city companies, and representatives of districts, will mainly deal with agreeing on the operational aspects of activities

and plans that require cross-sectoral coordination and cooperation, discussing their implementation and needed adjustments. The Internal Transition Team will also commission analyses concerning the impact of individual measures on various aspects of the city's functioning, particularly in terms of a just climate transition and the impact on residents' health and well-being. It will also cooperate with the External Transition Team within the framework of sectoral cooperation (concerning transport, energy, buildings, etc.).

**The External Transition Team**, composed additionally of city stakeholders (contract signatories and other interested representatives from business, science, civil society, and public institutions) will be in charge of: agreeing on sectoral activities and priorities, determining the field of cooperation, the contribution of individual stakeholders to the action, responsibilities and methods for verifying the effectiveness of the action, discussing the degree of implementation of the action, and needed adjustments.

Due to the large number of stakeholders, meetings focusing on specific sectors (buildings, energy, transport, etc.), among stakeholders involved in the sector, will be most appropriate. The External Transition Team will be able to set up working groups of selected stakeholders to work on developing new solutions (technical, organisational, funding, etc.), problem solving or project groups. It will also constitute a forum where stakeholders can share their knowledge, experiences, solutions and invite experts from specific fields with knowledge that can support particular activities or the CCC process itself.

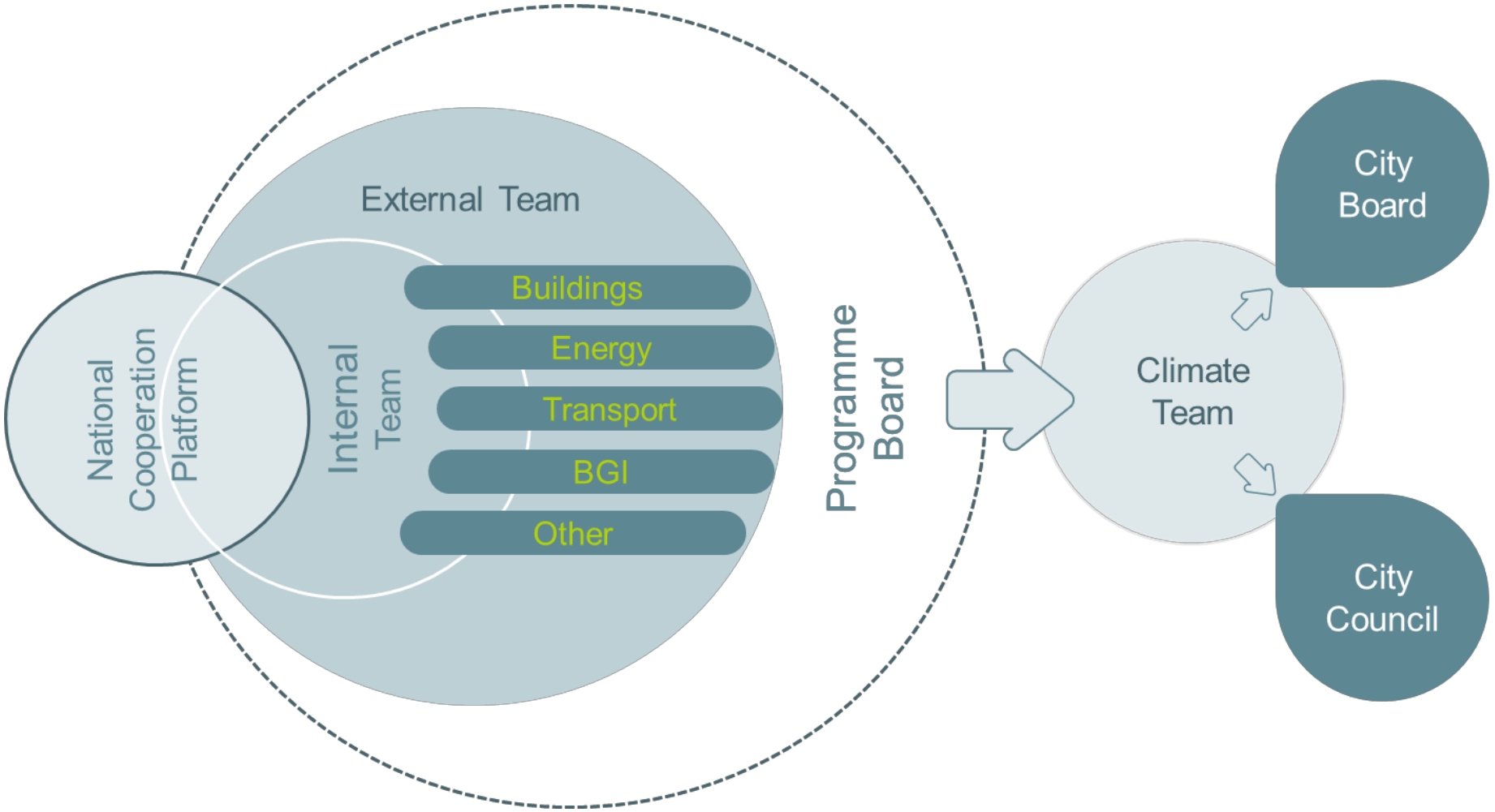
**Programme Board** - will meet periodically. These will consist of meetings of the entire Transition Team, with the participation of representatives of the boards of the districts implementing the climate contract and of the district councils, representatives of the government and central institutions, representatives of regional authorities, with the possibility of residents' participation. It will discuss crucial action plans and priorities, analyse the workflow and monitoring results, identify the needed directional changes, discuss proposals, as well as identify barriers and needs. The Board will also recommend the need to update the Climate City Contract.

**Cooperation with the Polish cities of the Mission** - Krakow, Lodz, Rzeszow and Wroclaw. This cooperation has resulted in a number of solutions that take into account the nationwide specifics. It has also resulted in cooperation with authorities at the national level, including individual ministries

**National Cooperation Platform** - bringing together representatives of the cities participating in the EC Mission and representatives of the Polish government, mainly ministries that are signatories to the CCC. Its aim is to discuss the manners of the needed support (legislative, financial, technical, etc.) and the necessary interventions at the national level to enable the CCC to be implemented and potential barriers to be addressed.

**Climate Team** - the results of monitoring the implementation of the Climate City Contract will be presented to the Climate Team. Key implementation findings and needs to support the implementation of activities or adjustments of activities at the strategic level (including CCC updates) will also be addressed to the team. The team will issue recommendations to the City Board concerning the mobilisation of additional resources or actions to facilitate, streamline contract implementation, and deal with identified barriers.

Reports concerning the progress in implementing the Climate City Contract will also be reported periodically to **the City Board** and **Warsaw City Council**.


External Team
National Cooperation Platform
Internal Team
Buildings
Energy
Transport
BGI
Other
Programme Board
Climate Team
City Board
City Council

# 5 Signatories

The table below lists the signatories who join this Climate City Contract and thus to help the city reach its goal of achieving climate neutrality by 2030 in the two designated districts of Praga-Południe and Ursynów. Annex 1 adds detailed contracts/agreements/letters of intent that set out the details of the declared pro-climate actions between the city and the signatories (see example in section 6). The number and significance of signatory commitments is likely to increase over time.

In the first stage, we start with the key stakeholders who have been invited to sign the CCC because of: the contribution they may bring to the planned activities, the need to develop all the key sectors for implementing the contract or because of the level of their own emissions. When implementing the Climate City Contract, we will gradually increase the number of signatories.

Contracts of the City of Warsaw are concluded on three levels:

1. A BASIC partnership, in terms of which a stakeholder signs a letter of intent expressing support for the objectives of the Climate City Contract and the actions of the City of Warsaw as well as a general declaration of substantive and organisational support for the Praga-Południe and Ursynów districts in their efforts to achieve climate neutrality by 2030.
2. A FRAMEWORK partnership in which the stakeholder expresses support for the aspirations of the districts of Praga-Południe and Ursynów to achieve climate neutrality by 2030 and declares a concrete contribution to the activities related to implementing the Climate City Contract of the City of Warsaw.
3. A PREMIUM Partnership: in which the stakeholder expresses support for the aspirations of the districts of Praga-Południe and Ursynów to achieve climate neutrality by 2030, pledges to contribute to activities related to implementing the Climate City Contract by the City of Warsaw and commits to taking concrete steps towards achieving its own climate neutrality by 2030.

| Signatory (name, organisation) | Sector/Area | Legal form / territorial cooperation scope | Name and surname of responsible person | Position of the responsible person |
|---|---|---|---|---|
| Miejskie Zakłady Autobusowe sp. z o. o. | Transport<br>Implementing a corporate strategy for supporting the objectives of the CCC. | Municipal company<br>citywide | Jan Kuźmiński<br>Kamil Królak | CEO<br>Board Member |
| Metro Warszawskie sp. z o.o. | Transport<br>Implementing a corporate strategy for supporting the objectives of the CCC. | Municipal company<br>citywide | Dariusz Kostaniak<br>Marek Sokołowski | Board Member<br>Board Member |
| Miejskie Przedsiębiorstwo Oczyszczania w m.st. Warszawie sp. z o.o. | Waste<br>Implementing a corporate strategy for supporting the objectives of the CCC. | Municipal company<br>citywide | Adam Chwieduk<br>Dariusz Wachnicki | CEO<br>Commercial Proxy |
| Mazowiecka Agencja Energetyczna sp. z o.o. | Energy<br>Cooperation in terms of using renewable energy sources and energy efficiency solutions. | Company<br>nationwide | Bartosz Dubiński | CEO |
| LOTTE Wedel sp. z o.o. | Energy, buildings<br>Implementing a corporate strategy for supporting the objectives of the CCC. | Company<br>nationwide | Maciej Herman | Board Member |
| Warsaw Metropolis Association | Transport, energy<br>Coordination of cooperation with neighbouring municipalities within the Warsaw Metropolis (concerning Ursynów). | NGO<br>regional | Michał Olszewski | CEO |
| SWPS University | Energy, buildings | University<br>citywide | dr Ewa Ger | General Director |

| | | | | |
|---|---|---|---|---|
| | Cooperation in the areas of innovation, education, and social dialogue, implementing its own development strategy in support of CCC objectives. | | | |
| Sports Totalizator Służewiec Race Track Branch | Energy, buildings, Nbs | Company<br>Ursynów | Dominik Nowacki | Branch Manager |
| University of Warsaw | Energy, buildings<br>Cooperation in the areas of innovation, education, and social dialogue, implementing its own development strategy in support of CCC objectives. | University<br>citywide | prof. dr hab. Ewa Krogulec | Vice-Rector for Development |
| CH Warszawa U Sp. z o.o. | Energy, buildings | Company<br>Ursynów | Grzegorz Grajkowski | Proxy, Director of Operations PL |
| Ursynów Sports and Recreation Center | Energy, buildings | Municipal institution<br>Ursynów | Piotr Kondratowicz | Director |
| Ministry of Climate and Environment | Energy, R&D, decarbonization | Central government | Paulina Henning- Kloska | Minister |
| PGNiG TERMIKA Energetyka Przemysłowa SA (Industrial Power Engineering) | Energy, decarbonization, buildings | Company<br>citywide | Michał Olszewski | Board Member |
| Warsaw University of Technology, Centre for Advanced Materials and Technologies | Energy, buildings, R&D, technology | University<br>citywide | Mariusz Wielec | Director |

| | | | | |
|---|---|---|---|---|
| Marshal of the Mazowieckie Voivodeship | Financial support, education | Central government<br>voivodeship | Adam Struzik | Marshal of the Mazowieckie Voivodeship |
| Veolia Energy Contracting Poland Sp. z o. o. | Energy, decarbonisation, buildings | Company<br>citywide | Piotr Ulicki | Board Member |
| Warsaw University of Life Sciences | Energy, R&D, technology, Nbs | University<br>citywide | prof. dr hab. Michał Zasada | Rector |
| Tramwaje Warszawskie Sp. z o.o. (Warsaw Trams) | Transport | Company<br>citywide | Wojciech Bartelski | CEO |
| Sendzimir Foundation | Nbs, education | NGO<br>National | Karolina Maliszewska | CEO |
| Housing cooperative – Stokłosy | Energy, buildings | Company<br>Ursynów | Krzysztof Berliński | CEO |
| Warsaw Waterworks | Energy, R&D, technology, Nbs | Company<br>citywide | Renata Tomusiak | CEO |
| PWPW (Polish Security Printing Works) | Finance | State Treasury company<br>national | Piotr Michalski | Vice-president for finance |

# 6 Signatures

We, the undersigned, agree with the goals and objectives of the Climate City Contract for the City of Warsaw, as described in the documents: Commitments, Action Plan and Investment Plan, and we are convinced that by working with a wide range of stakeholders we will come closer to achieving climate neutrality in our city.

Rafał Trzaskowski – Mayor of the City of Warsaw

..... .....

Date Signature

Tomasz Kucharski – Praga-Południe District Mayor

..... .....

Date Signature

Cezary Holdenmajer – Ursynów Deputy District Mayor

..... .....

Date Signature

# Annex 1: Individual/Group Commitments of Signatories

# Annex 2: Templates of letters of intent signed by stakeholders

## 1. BASIC partnership

This letter constitutes an expression of support for the City of Warsaw and implementing the City Climate Contract. The *[name of the entity]* is aware of the urgent need to work together to achieve climate neutrality and mitigate the effects of climate change as well achieve a sustainable urban future. Due to this, we applaud the initiative taken by the City of Warsaw in terms of implementing the City Climate Contract.

This Climate Contracts of the City of Warsaw is closely linked to the national commitment for implementing the assumptions of the European Green Deal and the Paris Agreement, to which Poland is a signatory. By supporting and participating in this commitment, we believe that we can accelerate progress towards our common goals and create meaningful change at the local and national levels as well as contribute to such change at the global level.

In addition, *[name of entity*] expresses the willingness to overcome challenges together and commits to ongoing cooperation and dialogue to systematically increase the city's resilience to climate change and make every effort to achieve climate neutrality. We perceive the implementation of the City Climate Contract of the City of Warsaw as a crucial step towards building a more resilient, just, and sustainable future for our community and our city.

On behalf of [*name of entity*]

…… ……

Name and surname Position

…… ……

Date Signature

On behalf of the City of Warsaw

Rafał Trzaskowski - Mayor of the City of Warsaw

…… ……

Date Signature

## 2. FRAMEWORK partnership

This letter constitutes an expression of support for the City of Warsaw and implementing the City Climate Contract. The [*name of the entity*] recognises the urgent need for joint action to achieve climate neutrality as well as to mitigate the effects of climate change, and to accelerate joint efforts to achieve a sustainable future for the city. Due to this, we appreciate and support the initiative taken by the City of Warsaw in terms of implementing the City Climate Contract.

This Climate Contracts of the City of Warsaw is closely linked to the national commitment for implementing the assumptions of the European Green Deal and the Paris Agreement, to which Poland is a signatory. By supporting and participating in this commitment, we believe that we can accelerate progress towards our common goals and create meaningful change at the local and national levels as well as contribute to such change at the global level.

Moreover, [*name of entity*] expresses the willingness to overcome challenges together and commits to ongoing cooperation and dialogue to systematically increase the city's resilience to climate change and make every effort to achieve climate neutrality. We perceive the implementation of the City Climate Contract of the City of Warsaw as a crucial step towards building a more resilient, just, and sustainable future for our community and our city.

As part of our cooperation, we are committed to supporting the City of Warsaw in its quest for climate neutrality through the following measures:

- .....
- .....
- .....

On behalf of [*name of entity*]

..... .....

Name and surname Position

..... .....

Date Signature

On behalf of the City of Warsaw

Rafał Trzaskowski - Mayor of the City of Warsaw

..... .....

Date Signature

## 3. PREMIUM partnership

This letter constitutes an expression of support for the City of Warsaw and implementing the City Climate Contract. The [*name of the entity*] recognises the urgent need for joint action to achieve climate neutrality as well as to mitigate the effects of climate change, and to accelerate joint efforts to achieve a sustainable future for the city. Therefore, we agree with the initiative taken by the City of Warsaw to implement the City Climate Contract.

This City Climate Contract of the City of Warsaw is closely linked to the national commitment for implementing the assumptions of the European Green Deal and the Paris Agreement, to which Poland is a signatory. By supporting and participating in this commitment, we believe that we can accelerate progress towards implementing our shared goals and bring about change at the local and national level as well as contribute to climate improvements at the global level.

Moreover, [*name of entity*] expresses the willingness to overcome challenges together and commits to ongoing cooperation and dialogue to systematically increase the city's resilience to climate change and make every effort to achieve climate neutrality. We perceive the implementation of the City Climate Contract of the City of Warsaw as a crucial step towards building a more resilient, just, and sustainable future for our community and our city.

As part of our cooperation, we are committed to supporting the City of Warsaw in its quest for climate neutrality through the following measures:

- .....
- .....
- .....

At the same time, in terms of a joint effort to increase the city's resilience to climate change and taking action to achieve climate neutrality, we commit to develop and implement an internal strategy of [*name of entity*] to pursue climate neutrality and sustainability in the city/[*name of district*] area.

On behalf of [*name of entity*]

..... .....

Name and surname Position

..... .....

Date Signature

On behalf of the City of Warsaw

Rafał Trzaskowski - Mayor of the City of Warsaw

..... .....

Date Signature

# THE CLIMATE CHANGE ADAPTATION STRATEGY FOR THE CITY OF WARSAW BY 2030 WITH THE PROSPECTS UNTIL 2050

## URBAN ADAPTATION PLAN

Project LIFE_ADAPTCITY_PL co-funded from the funds of the European Commission financial instrument LIFE+ and the National Fund for Environmental Protection and Water Management

The Climate Change Adaptation Strategy for the city of Warsaw by 2030 with the prospects until 2050 Urban Adaptation Plan has been developed through the concerted effort of Warsaw residents, entrepreneurs, representatives of various organisations, and the City of Warsaw authorities.

Warsaw, 4th July 2019

Dear Reader,

Climate change affects most European cities, including Warsaw. For the sake of residents' safety, we must be prepared for extreme weather events, such as heat waves, droughts or heavy rains, which are more and more frequent. For this purpose, the Urban Adaptation Plan was created. The strategic document will set the directions for the spatial development and the budget of the city. It is not only a theory, but real actions that strengthen the city's resilience. Implementation of the Plan will positively affect the quality of life of Warsaw residents - provide a sense of comfort and protect their health.

Can cities play an important role in the fight against global warming? Certainly Yes! It is important to invest in public transport, renewable energy sources, improve energy efficiency and air quality, greening the city and save water resources. Thinking about future steps, we all have to look through the climate lens and raise awareness. We also have to take care of nature, because we are a part of it.

Rafał Trzaskowski

Rafał Trzaskowski

Mayor of Warsaw

# CONTENTS

# INTRODUCTION

Big cities today are already experiencing the effects of the climate change which affect many aspects of their functioning. Intense urbanization and high population density, decrease in the share of biologically active area and hence reduced potential of rainwater retention, all that reinforces the consequences of these changes. On top of that, there are extreme weather events, such as heavy precipitation, rainstorms or floods. Heat waves and droughts cause a lot of material and immaterial damage and pose direct risk to human health and life.

The subject of climate change has been treated very seriously in Warsaw for many years. In 2008 the Climate Protection Team was appointed with one of the objectives: to inspire and launch activities mitigating climate change impacts by reduction of the emission of greenhouse gases, particularly, carbon dioxide. As a result of this action, in 2009 Warsaw joined the European initiative The Covenant of Mayors, and in 2011 Sustainable Energy Action Plan for Warsaw in the perspective of 2020[1], and then in 2015, the Warsaw Low Carbon Economy Plan[2] were adopted. The preparation of the Adaptation Strategy constitutes the next, natural step in the implementation of the City's climate policy. This document sets the action lines consistent with the United Nations Sustainable Development Goals[3], especially with Goal 11 Make cities and human settlements inclusive, safe, resilient and sustainable, and Goal 13 Take urgent action to combat climate change and its impacts.

The best tools of modern climatology – the hydrodynamic climate models - have been used to carry out the analyses and prepare forecasts concerning the climate changes that will take place in the Warsaw agglomeration in the 21st century. The results suggest that the climate in Warsaw will be significantly warmer in future. So much so, that it will transfer us all into a yet unknown climate zone. The temperature growth trends are visible in all the analysed thermal characteristics. The simulations also point to an increase in both average and maximum precipitation levels, while at the same time they do not forecast any substantial changes regarding periods without precipitation.

Therefore it has become necessary to assess which groups of residents and which sectors of the city life are exposed to climate change. Such an assessment makes it easier to take decisions about the lines of action and investment outlays which can prevent huge financial losses or threats to the life and health of the city residents. Public participation is one of the main success factors in the implementation of individual measures and in adapting them to the residents' needs. It will also help to involve the residents, from the very beginning, in the protective actions, which will result in more rational and informed behaviour in case of threat and, in addition, will increase their safety. Finding the

[1] The document adopted by a resolution of the Warsaw City Council No. XXII/443/2011 dated 8 September 2011

[2] The document adopted by a resolution of the Warsaw City Council No. XXI/522/2015 dated 10 December 2015

[3] More at http://www.un.org.pl/

right solutions will also have positive impact on various elements of the infrastructure thus improving the comfort of living in the city.

Climate change adaptation action entails substantial expenditure, which should be seen in relation to the level of losses incurred during undesirable weather events. With the awareness growing as a result of the availability of climate change forecasts, it is possible to undertake action to prevent or mitigate the negative impacts of climate change. Thus it is possible to avoid damage caused by extreme weather events whose cost would be disproportionately high compared to the cost of preventive action. It should also be noted that adaptation action creates a new market for innovative solutions, improving the standing of the city in Poland and in Europe. It is expected that, in the nearest future, there will be a significant increase in the use of funds for adaptation--related projects. The European Union, taking notice of this trend and the need for protection against the negative consequences of climate change, has included expenses related to such actions in its policies. This funding will only be available to the local government authorities that have the relevant strategic documents in place.

Adaptation and mitigation actions must be implemented simultaneously, while the resources available in the city must be used in a rational manner. Integration of those actions will help to improve the condition of the environment, the quality of the urban space and to raise the climate policy awareness of the city residents, thus influencing the quality of our life and that of the future generations.

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# 1. FACTORS DETERMINING THE PREPARATION OF THE DOCUMENT

## 1.1. FORMAL CONSIDERATIONS

Climate Change Adaptation Strategy for the city of Warsaw is consistent with the EU commitments of Poland regarding adaptation to climate change. On 29 October 2013, the Council of Ministers adopted the document „Strategic adaptation plan for sectors and areas vulnerable to climate change by 2020 with the prospects until 2030" (SPA 2020), which „... was prepared with the aim to provide conditions for stable social and economic development in the context of the risks posed by climate change, but also to take advantage of the positive effect that the adaptation actions may have not only on the condition of the environment in Poland, but also on the economic growth."

Since urban areas are the ones where negative impacts of the climate change will be the strongest, in January 2017 the Ministry of Environment launched a two-year project evaluating the vulnerability to climate change of the biggest Polish cities and planning adaptation measures appropriate to the identified threats, reflected in the Urban Adaptation Plan of individual cities.

Warsaw was not part of the ministerial project because the preparation of the documents programming the development of the city, taking into account the climate risk, had begun 2.5 years earlier. The project entitled „Preparation of a climate change adaptation strategy for the city of Warsaw, with the use of city climate mapping and with public participation", in short, ADAPTCITY , of which this document is the most important deliverable, was launched on 1 July 2014.

## 1.2. CLIMATIC CONDITIONS

Climate change, that is, the process of climate warming, is already taking place and will continue. The forecasts of the Fifth Report of the Intergovernmental Panel on Climate Change - IPCC[5]) show that Poland will experience the highest increase in temperature among the countries of our region - together with countries such as Sweden, Latvia and Lithuania. The occurrence of very high temperatures can increase the death rate, particularly in big cities, exposed to the so called urban heat island effect. In the period 1750 - 2013, the average annual temperature in Warsaw rose by almost 2°C, and, according to the two climate change scenarios developed for the purpose of this report, by the end of the century, depending on the action taken, it can grow by 3.5°C to 5°C.

Both the findings of UN Intergovernmental Panel for Climate Change studies as well as the KLIMADA[6] project, predict that Poland will experience a significant increase in the frequency/ intensity of heat waves, occurrence of droughts, the number and intensity of floods, heavy rainfalls and strong winds. The analyses conducted for the purpose of this document have shown that Warsaw is exposed to the same threats. This is an important reason to undertake action to adapt to climate change.

[5] The Fifth IPCC Report, 2013, https://www.ipcc.ch/

[6] KLIMADA Project "Development and implementation of the strategic adaptation plan for the sectors and areas vulnerable to climate change, coordinated by the Ministry of Environment; http://klimada.mos.gov.pl/

At the same time, the Special Report of the Intergovernmental Panel for Climate Change concerning the reduction of the global rise in temperature to 1.5°C[7] emphasizes that at present, the level of global warming has risen by about 1°C compared to the pre-industrial era, while it is possible to avoid long-term and irreversible negative impacts of climate change by limiting the increase in the average global temperature to not more than 1.5°C. Any warming of the climate higher than 1.5°C increases the risk of long-term or irreversible changes. According to the report of the World Meteorological Organization, the year 2018 was one of the warmest years on record (that is, from the 19th century). In spite of the Agreement concluded at the Climate Summit in Paris in 2015, world greenhouse gas emissions are still growing (e.g., between 2017 and 2018 they increased by 1.6%), whereas according to the above mentioned Special Report, by 2030 they should fall by 45% compared to the 2010 levels.

With the continuing climate change, it is important to manage the climate risk properly. This is made possible by providing appropriate tools, especially to the local government. Such tools will help improve the adaptability of households, enterprises, public institutions, civil society organisations as well as individual residents. They will also help increase awareness, build up knowledge and share information and will influence the ability to implement measures that enhance the resilience of the city and its infrastructure, enabling it to avoid damage and to restore proper operation of the city functions, both with respect to the residents and the economy, if any negative consequences of climate change occur.

[7] IPCC Special Report of 8 October 2018, on reducing the global temperature growth to 1.5°C, https://www.ipcc.ch/

The most important objective of the measures adapting Warsaw to climate change is to improve the safety of its residents, exposed directly or indirectly to weather extremes and their effects. These measures should focus on protecting the city against the consequences of extreme weather events and on mitigating their impact, such as losses caused by flooding and heavy rains, increase in the mortality rate caused by heat waves, decline in the diversity of the ecosystems providing services to the city and its residents.

There are numerous analyses focusing on the economic rationale for adaptation to climate change. They all indicate that failure to take appropriate action will lead to the generation of inaction costs, that is, costs that may arise as a result of future damage, which will be considerably higher, both economically and socially, than the costs the adaptation measures[8] .

According to the Green Paper on Insurance of Natural and Man-made Disaster[9] in the initial period of adaptation, focused on management issues, one should expect growth in the economy and in employment. The second phase should contribute to the reduction of losses associated with extreme weather events. The third phase means a high rate of return on the investments made.

Adaptation to climate change is a process which definitely enhances the competitiveness of the city, improves the quality of life and healthcare, helps create attractive and safe spaces, improves the level of environmental protection and creates demand for modern technologies and jobs.

[8] Bukowski M., Gąska J., The Institute for Structural Research, Oszacowanie skutków ekstremalnych zjawisk klimatycznych przy zaniechaniu działań adaptacyjnych, 2012.

[9] Green Paper on Insurance of Natural and Man-made Disaster. European Commission. Strasbourg. 2013.


PGE
NARODOWY

# 2.INFORMATION ABOUT THE DOCUMENT – WORKS FORMAT

The city of Warsaw began the work on preparing the documents programming the development of the city while taking account of the climate risk, on 1 July 2014, with the accession to the ADAPTCITY project. The Project made it possible to have a number of expert analyses carried out and to secure the broad stakeholders' commitment. The structure of the document follows the guidelines of the Ministry of the Environment for preparing documents of this type[10].

This document, the "Climate Change Adaptation Strategy for the city of Warsaw by 2030, with the prospects until 2050. Urban Adaptation Plan" defines the city's policy[11] aimed at preparing and adapting Warsaw to the progressing climate change.

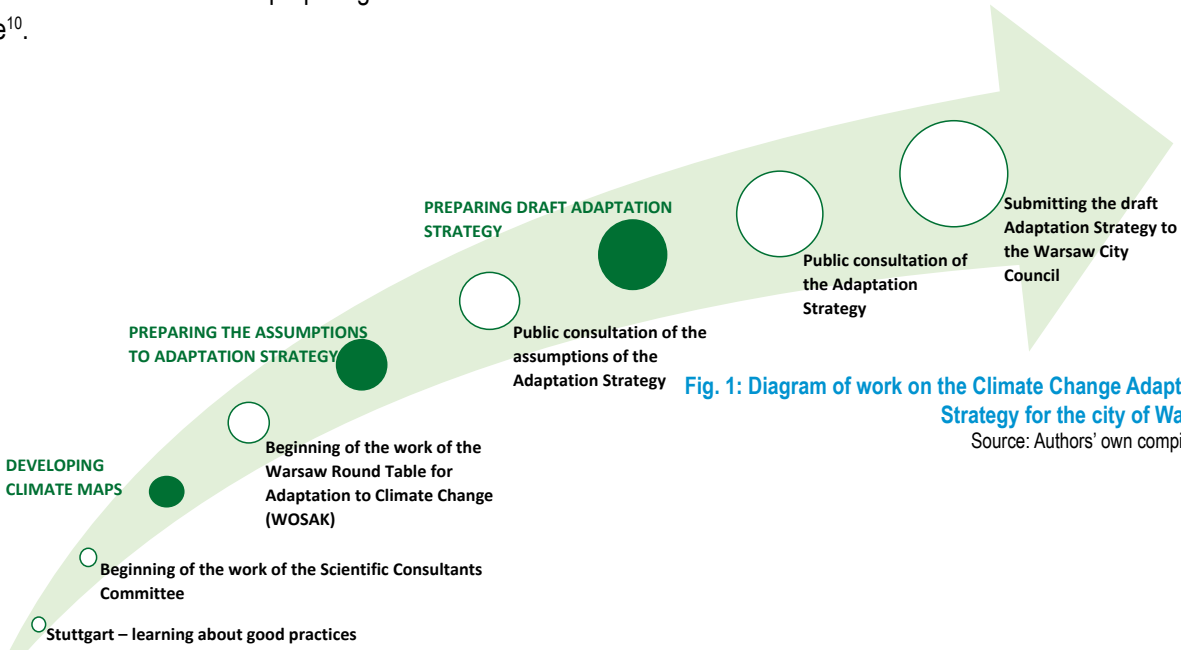



**Fig. 1: Diagram of work on the Climate Change Adaptation Strategy for the city of Warsaw**
Source: Authors' own compilation.

[10] Podręcznik adaptacji dla miast – wytyczne do przygotowania Miejskiego Planu Adaptacji do zmian klimatu, Ministerstwo Środowiska, 2014. [Adaptation Handbook for Cities – guidelines for preparing the Urban Climate Change Adaptation, Ministry of Environment 2014]

[11] The document plays the role of a policy document for the Strategy #Warszawa2030 and sets the rules and guidelines for the urban climate change adaptation programmes, in accordance with the Regulation No. 1868/2017 of the Mayor of Warsaw dated 5 December 2017 on introducing standard documents programming the development of the city of Warsaw.

The work on the Adaptation Strategy began with the Team working on the document getting acquainted with the good practices applied in Stuttgart, a partner of the ADAPTCITY Project. Drawing from the experience of the German partner, after conducting a number of studies and analyses, the Committee of Scientific Consultants developed the Warsaw Climatic Atlas[12] . The work on the maps was conducted by scientists from the Faculty of Geography and Regional Studies of the Warsaw University, with the participation of the Warsaw University Interdisciplinary Centre of Mathematical Modelling. The Atlas comprises maps which provide a lot of valuable information, showing the threats that the city may face. They present the occurrence of various weather events in Warsaw in recent years, including precipitation, a rise in temperature, storms or strong winds, as well as a list of scenarios predicting what pattern they may form as a result of climate change by the end of the 21st century. They show the risk of the occurrence of heat waves, harsh frosts, severe precipitation, heat island effects appearing in different places in the city.

The development of the Adaptation Strategy has been a multistage process, conducted with the broad participation of the public. The document is the effect of the cooperation between the residents of Warsaw, representatives of civil society organisations, entrepreneurs, a team of scientists and experts and the city authorities. The participation process began in September 2016, when the first of six meetings of the Warsaw Round Table for Adaptation to Climate Change (WOSAK)[13] was held. WOSAK's work was completed in January 2017 with the drafting of the Assumptions to the Climate Change Adaptation Strategy for the city of Warsaw by 2030 with the prospects until 2050[14] That document was the subject of public consultation[15] conducted between February and June 2017. The problems related to climate change were discussed with the residents of the city at 18 meetings and during outdoor family picnics. Groups of professionals were also invited to debate (teachers, healthcare sector, services responsible for security and crisis management and the institutions in charge of the broadly understood water management) as were City Bureaus and organisational units of the Warsaw City Hall. This activity resulted in the preparation of the document "Climate Change Adaptation Strategy for the city of Warsaw by 2030 with the prospects until 2050. Urban Adaptation Plan", submitted to the people of Warsaw for consultation[16] in February-March 2019.

After collecting the opinions and examining the list of problems, the final draft of the Adaptation Strategy was prepared, taking account of the entirety of the issues related to adapting Warsaw to climate change. The document describes the main threats resulting from climate change and the related risk areas that may affect Warsaw and its residents. It also proposes the lines of action needed to protect us against the negative impacts of the climate change-related phenomena.

[12] The maps are available at mapa.um.warszawa.pl

[13] The report on the WOSAK work available on adaptcity.pl

[14] http://adaptcity.pl/pobrania/publikacje/

[15] The report on public consultations concerning the assumptions to the Climate Change Adaptation Strategy for the city of Warsaw by 2030 with the prospects until 2050 available on konsultacje.um.warszawa.pl

[16] The report on public consultations concerning the document "Climate change Adaptation Strategy for the city of Warsaw by 2030 with the prospects until 2050. Urban Adaptation Plan" available on konsultacje.um.warszawa.pl

# 3. DIAGNOSIS

## 3.1. CLIMATE OF WARSAW AND ITS EXPECTED CHANGES

The geographical location makes the climate of Warsaw a result of the combined impact of humid and mild sea air, dry and harsh continental air and icy cold Arctic air or hot Mediterranean air (transitional climate). This means that these four different air masses move over the city, changing with great frequency, and as a result, the weather is extremely variable.

Throughout almost entire 20th century, the climatic conditions of Warsaw were the following:

- The average annual temperature for individual years in this period ranged from 7oC to 8oC. Within a year, the lowest temperatures were noted in January, the highest – in July. The average number of hot days during the year (with average temperature above 25oC) was about 40.
- The annual precipitation was approx. 520 mm, the highest monthly precipitation was noted in July, the lowest – in February.
- Snow coverage was present for 50 to 60 days in a year with 33 freezing days (average temperature below 0oC).
- Average wind speed in the city was approx. 4 m/s.

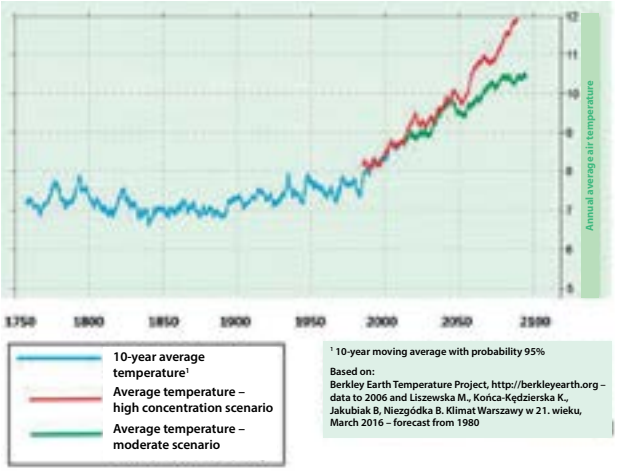



**Fig. 2 Average temperature in Warsaw in the period 1750 – 2013 and possible change scenarios**[17]

[17] **Moderate scenario**, labelled as RCP 4,5, that is, representative GHGs concentration pathway (RPC) leading to radiative forcing (an alteration in the radiative equilibrium in the Earth's atmosphere connected with a distortion in the climate system) at the level of 4.5 W/m2. For such a scenario to occur it will be necessary to reduce the use of energy, to halt the changes in land use, to increase the share of forested areas and deploy carbon capture and storage technologies.
**High concentration scenario** labelled as RCP8,5 that is, representative GHGs concentration pathway (RPC) leading to radiative forcing (an alteration in the radiative equilibrium in the Earth's atmosphere connected with a distortion in the climate system) at the level of 8.5 W/m2. This "business as usual" scenario means that nothing will change in the functioning of the city. The population will increase significantly while the income will rise relatively slowly, changes in technology and improvement of energy efficiency will be rather modest, leading, in the long term, to high demand for energy and high emission of greenhouse gases not accompanied by any policy addressing climate change.
Source: Climate Change 2014 Synthesis Report. Intergovernmental Panel for Climate Change.

Already at the end of the 20th century and at the beginning of the 21st century these conditions have changed. The following has been observed since the 1990s:

- An increase in the average annual temperature. The average annual temperature in the city has already exceeded 8oC and in the central parts of the city – even 10oC. The increase in temperature can be blamed on both, the so called urban heat island effect and the global climate warming.
- Shorter periods with snow coverage and a greater number of hot days. A decrease in the number of freezing days has not been observed. There have been more sudden and heavy rainfalls in the summer.

The observations and studies conducted in the years 1981 – 2014 have made it possible to describe the key phenomena connected with climate which have negative impact on the city and its residents.

### 1. Increase in air temperature and thus an increase in the number and intensity of very hot days.

In the period 1981 – 2014, an annual increase was observed in the number of hot days and tropical nights (according to the scenarios applied by the IPCC, adapted for the purpose of assessing the changes in the climate of Warsaw, this increase will be progressing (Fig. 3., Fig. 4.). This leads to a greater demand for cooling in summer and therefore potential shortage of energy, possible deterioration of air quality (occurrence of smog in summer - photochemical smog), deepening of the urban heat island effect (Fig. 5.), increased demand for water or direct threat to the lives of the residents. Those most vulnerable to the risks associated with high air temperature and solar exposure are mainly elderly people (over 65 years of age), young children, people suffering from respiratory system and cardio-vascular diseases, people with disabilities, especially with reduced mobility, as well as the homeless[19]

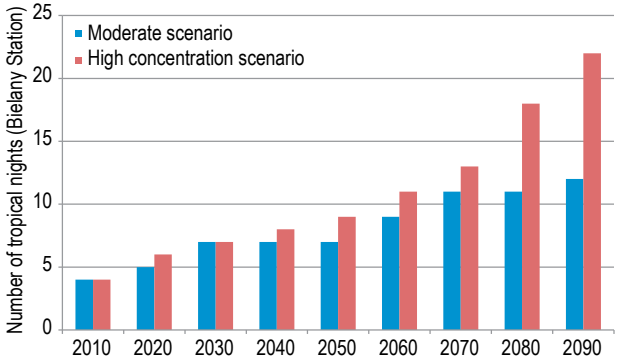



**Fig. 3. Number of tropical nights in Warsaw in 2010 and forecasted by 2090**

Source: Compiled by Kinga Nelken, on the basis of climate change scenarios for the city of Warsaw in the 21st century.

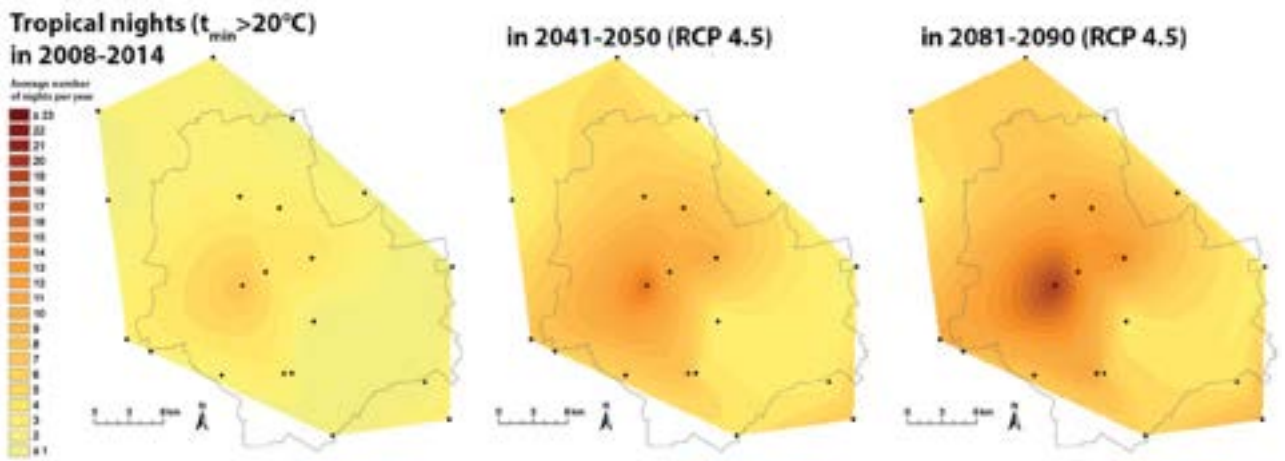



**Fig. 4. Number of tropical nights in Warsaw 2008 – 2014 and forecasted by 2090 according to the moderate scenario of temperature increase**

Source: Compiled by Kinga Nelken, on the basis of climate change scenarios for the city of Warsaw in the 21st century.

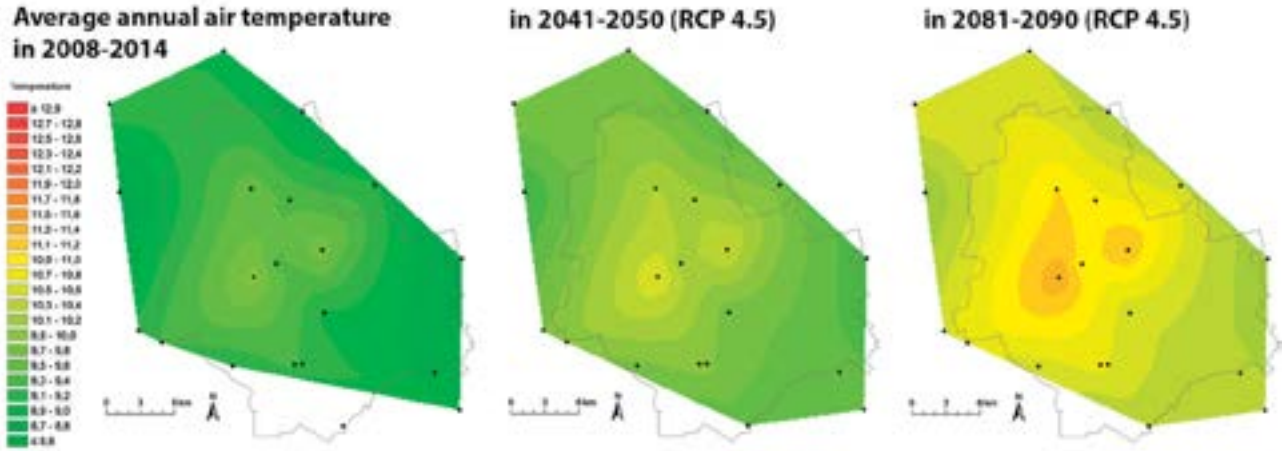



**Fig. 5. Average annual air temperature in Warsaw in the years 2008 – 2014 and the temperature forecasts by 2090 under the moderate scenario of temperature increase**

Source: Compiled by Kinga Nelken, on the basis of climate change scenarios for the city of Warsaw in the 21st century.

## 2. Increase in the frequency and intensity of precipitation causing local flooding

The period under analysis, the years 1981 - 2013 was marked by a statistically significant increase in annual precipitation, mainly in the southern part of Warsaw. The number of days with high precipitation (above 10 mm of water/m2) increased and growing single rainfall levels (over 90 mm of water /m2) were observed. It is expected that this trend, according to the climate change scenarios for the city, will continue. First of all, the number of short--time rainfalls with high intensity, causing local flooding will grow (Fig. 6., Fig. 7.). This will lead not only to transport difficulties but will also pose a threat to property and lives of the people who will find themselves within the reach of the quickly rising waters.

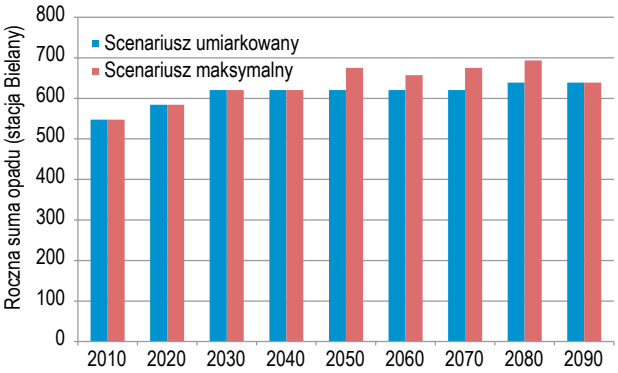



**Fig. 6. Forecasted annual precipitation by 2090**

Source: Compiled by Paweł Milewski, on the basis of climate change scenarios for the city of Warsaw in the 21st century.

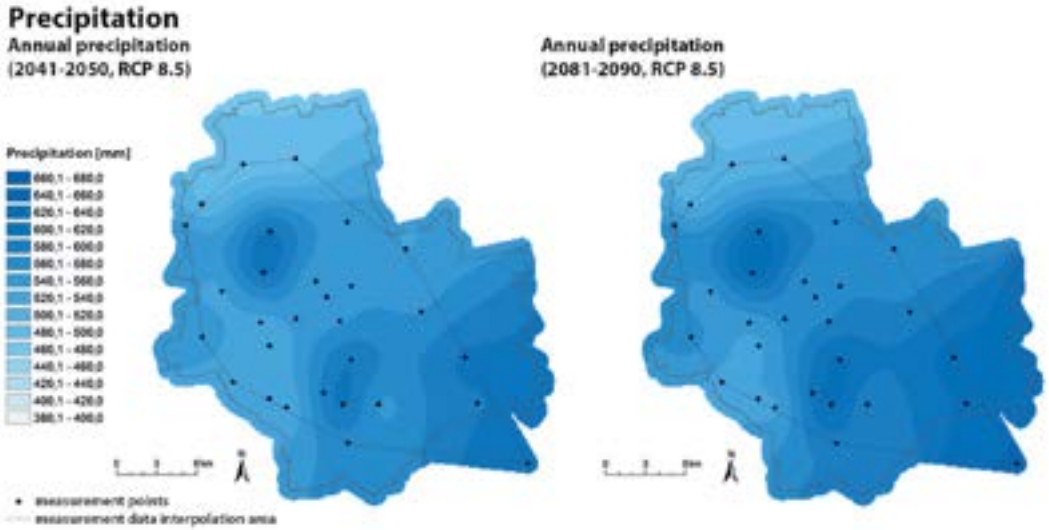



**Fig. 7. Forecasted annual precipitation by 2090 according to the extreme climate change scenario.**

Source: Compiled by Paweł Milewski, on the basis of climate change scenarios for the city of Warsaw in the 21st century.

### 3. Increase in the intensity and scale of flooding or drought

In the years 2008 - 2014, in Warsaw, dry periods prevailed, but the rainy periods occurring between them had unprecedented intense nature. According to forecasts, we should expect an increase in the frequency of extreme events such as floods. The above is confirmed by the results of the KLIMADA project, which concludes that as a result of climate change, in the coming years, the number of floods will increase.

In 2010, the flood wave moved through Warsaw twice in rapid succession (in May and June). Another similar event, albeit on a smaller scale, took place in 2012. The levees along the Vistula River protect the city from a 1-in-100 year flood wave (Table 1). It is, however, anticipated that such flooding might occur more than once in a century, although the anticipation is based on historical data, and not only on analyses of future climate changes. Locally, also smaller water courses within the city limits may pose a threat, such as Bródnowski Canal, the Długa River or the Służewiecki Brook, whose swelling waters can be even more troublesome because of the increasing scale of single extreme rainfalls.

**Table 1. Flood risks in Warsaw by districts**

| Districts that can potentially be flooded | Number of people living in the areas that can potentially be exposed to flooding in case of a flood from the Vistula River | | |
|---|---|---|---|
| | 1-in-10-year flood Probability of occurrence – once in 10 years p=10% | 1-in-100-year flood Probability of occurrence – once in 100 years p=1% | 1-in-1000-year flood Probability of occurrence – once in 1000 years p=0,1% |
| **Right bank** | **103 787** | **194 851** | **424 006** |
| Wawer | 2 428 | 2 680 | 8 758 |
| Praga Pd. | 83 772 | 120 360 | 184 202 |
| Praga Pn. | 1 399 | 2 124 | 63 601 |
| Rembertów | 0 | 0 | 776 |
| Targówek | 0 | 33 903 | 119 398 |
| Białołęka | 16 188 | 35 784 | 47 271 |
| **Left bank** | **7 061** | **22 026** | **118 932** |
| Wilanów | 907 | 1 434 | 11 146 |
| Mokotów | 4 318 | 6 780 | 70 963 |
| Śródmieście | 0 | 5 105 | 22 696 |
| Żolibórz | 208 | 2 900 | 5 858 |
| Bielany | 1628 | 5807 | 8 269 |
| Total | 110 848 | 216 779 | 542 938 |

Source: Zasięg zalewów dolinowych Wisły w gorsecie warszawskim. Witold Jaworski, Michał Marcinkowski, Artur Magnuszewski 2005

### 4. Increased intensity of storms and strong winds

The number of days with strong wind and the average wind speed throughout the year decreased in the years 1981 - 2013. However, isolated episodes of hurricane wind in the city led to ever more dangerous effects. They had been brought by increasingly deeper low-pressure systems flowing over Poland from the Atlantic. Combined with violent storms, strong wind always brought serious negative impacts on the city: disruptions of power supply, fallen trees, disruptions in transport services as well as fatalities. At present, there are no reliable predictions as to changes in the intensity of storms and strong winds by the end of the 21st century. Some positive phenomena that may occur as a result of the predicted climate change should also be brought to attention.

Higher air temperature, both within the urban heat island and as a result of the overall change of the climate may lead to the following:

- Decrease in the number of days with snowfall and thus to shortening the periods with snow cover,
- Extending the plant growing season,
- Shortening of the heating period.

However, it must be remembered that the threats resulting from climate change are disproportionately higher than the benefits.

## 3.2. TOWS ANALYSIS[20]

The diagnosis of the status of climate change and Warsaw's options to adapt to them has the structure of TOWS analysis, while its individual elements bear their own names derived from the nature of the conducted analyses[21].

First, **the Exposure Analysis** was performed, which constituted the Analysis of climate threats. Further analyses were conducted only with reference to the threats identified at this stage. Opportunities (that is, reduction of the scale of the threats), resulting from the exposure analysis, were taken into account only at the stage of developing the actions on the basis of the entire analysis.

[20] The English abbreviation SWOT reads as: Strengths, Weaknesses, Opportunities, Threats. The SWOT analysis is carried out by analysing the factors described by the letters of the acronym, from the strengths through to threats. TOWS means an analysis of the same elements carried out in the reversed order, from threats through to strengths.

[21] Names of the analyses have been adopted following the Podręcznik adaptacji dla miast – wytyczne do przygotowania Miejskiego Planu Adaptacji do zmian klimatu, Ministerstwo Środowiska, 2014 [Adaptation Manual for Cities – guideline for preparing an Urban Climate Change Adaptation Plan, Ministry of Environment 2014] .

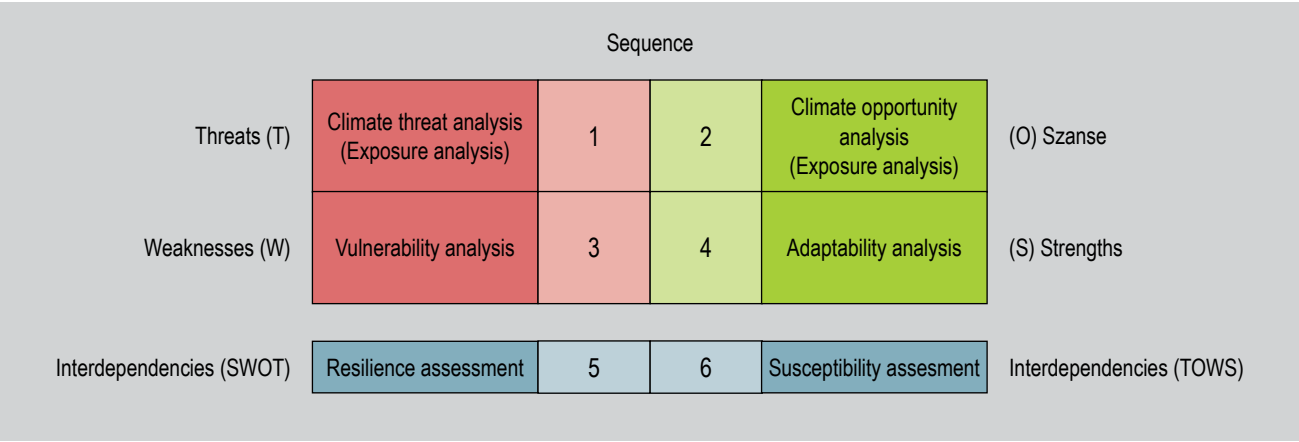



**Fig. 8. Names and sequence of the analyses carried out for the purposes of the Climate Change Adaptation Strategy for the city of Warsaw shown on the TOWS analysis diagram**

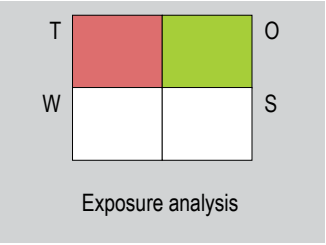
Source: Authors' own compilation.

During **the Vulnerability Analysis**, based on the assessment of the potential occurrence of negative and positive impacts on the city (people, built-up areas including technical infrastructure and the natural environment, together with green and blue infrastructure) as a result of climate change threats (flood events, flooding, heat waves, droughts, violent storms, strong winds), the vulnerability of the city to climate change was estimated.

This was followed by **the Adaptability Analysis**, which assessed the characteristics of the city and the actions that the urban community can take or is prepared to take in case of extreme weather events and other negative effects of climate change, which consequently help to withstand these adverse phenomena.

The next step was **the Susceptibility Analysis** - analysis of interdependencies between elements of the TOWS analysis. In particular, this analysis sought answers to the questions of how adaptability affects the reduction of vulnerability (resilience assessment) and how the scale of climate threats affects the city's resilience level (susceptibility assessment). The extent to which the city is unable to cope with the negative impacts of climate change or seize the opportunities associated with climate change has been determined. Susceptibility is a function of the type, intensity, scale and speed of the changes to which a city is exposed, its vulnerability and adaptability.

### 3.2.1. Exposure Analysis
### (analysis of climate threats and opportunities)



Exposure analysis

In the analysis of the city's exposure, a number of climate factors have been taken into account, analysed on the basis of data from the years 1981 – 2014, including the following:

- *Average air temperature,*
- *Extreme above-zero temperature,*
- *Extreme sub-zero temperature,*
- *solar radiation,*
- *anual precipitation,*
- *heavy rainfalls,*
- *snowfall and snow buildup,*
- *humidity,*
- *average wind speed,*
- *maximum wind speed,*
- *tornadoes and whirlwinds,*
- *storms (lightning),*
- *drought,*
- *floods,*
- *growing season,*

and the current level of exposure has been determined using a three-grade scale: high, medium, low.

Possible directions of changes in these climate factors were analysed, taking into account the analysis of climate change scenarios for Warsaw. The trend of the change had an impact on the raising or lowering of the current assessment

### Exposure to climatic factors

| Factor | Scale of phenomenon | Probability of occurrence during a year – so far | Exposure so far | Climate change by 2050 | Future exposure |
|---|---|---|---|---|---|
| Average air temperature | 8,6-8,8 °C | n/a, whole year | Low | Increase by 1-2 oC | Low |
| Annual precipitation | 520-540mm | n/a, whole year | Low | Increase by 3-5% | Low |
| Average wind speed | 4,3-4,4 m/s | n/a, whole year | Low | Lower average speed | Low |
| Humidity | 78-80% | n/a, whole year | Low | No change or decrease by 0,5% | Low |
| Solar radiation | 1600-1700 hours | 18-19% | Low | No change or decrease | Low |
| Tornadoes and whirlwinds | 0 | <1% | Low | No change | Low |
| Plant growing season | 210-220 days | 60% | Low | Extension by 10-20 days | Low |
| Extreme above-zero temperature | >30 oC approx. 7 days per year | 2% | Medium | Increase by 2-4 days | High |
| Extreme sub-zero temperature | <-10 oC, 14 days per year | 4% | Medium | Decrease by 5-10 days | Low |
| Heavy rainfall | Heavy rainfall above 10mm approx. 13 days per year | 3,50% | Medium | Increase by 7-8 days, higher maximum level of precipi-tation | High |
| Snowfall and snow buildup | 50 to 60 days per year with snow coverage | 15% (snow coverage) | Medium | Fewer days with snow coverage | Low |
| Drought | Dry periods exceeding 20 days - 2 times a year | 10-11% | Medium | No change in no. of days | Medium |
| Maximum wind speed | Wind speed >10m/s | do 30% | Medium | No change or slight decrease | Medium |
| Storms (lightning) | Number of storms per year – approx. 30 | 8% | Low | Increase in number and strength | Low |
| Floods | 1-in-100, 1-in-500 or 1-in-1000-year flood | 1% | High | Increase in number | High |

Source: Authors' own compilation.

**HIGH AND MEDIUM EXPOSURE**

Future high exposure for the following climate factors:

- **extreme above-zero temperature** – the period in which such temperatures occur may significantly extend, increasing the number of events such as very hot days, tropical nights and the related negative effects on people's health;
- heavy rainfalls – both the volume of a single rainfall may increase as well as the number of days with high precipitation which have so far caused severe losses in the city because of flooding ;
- floods – there may be an increase in the number of events involving high water level in the Vistula River or its tributaries located within the city limits; the high water level may increase further.

Future medium exposure for the following climate factors:

- **droughts (dry periods)** – the length of periods without precipitation may remain the same but the severity of droughts will increase because of the increasing average and maximum air temperatures and the variability of the precipitation characteristics;
- **strong wind** – episodes of strong wind have so far brought seasonal problems for the functioning of the city; this should essentially not change, the strength of the wind and the number of strong wind periods should not change, either.

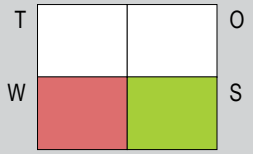
**LOW EXPOSURE**

For the following climate factors the exposure will fall to low:

- extreme sub-zero temperatures – the current medium exposure of the city has been replaced with low exposure in this respect because the number of such days may decrease even by half, below the number of days with extreme above-zero temperature;
- snowfall and snow build-up – the current medium level of exposure has been replaced with low exposure in this respect, because together with the decrease in the number of days with low temperature, the number of snowfalls and the period with snow coverage will decrease from several dozen to just several days in a year.

Further analyses take into account the climate threats to which the city's exposure will be medium or high.

### 3.2.2. Analysis of vulnerability and adaptability




Analysis of vulnerability and adaptability

The analyses focus on the city characteristics from the point of view of climate change, namely its vulnerability and adaptability[22] . Vulnerability is a set of city's weaknesses, adaptability is its strength. Their assessment has been based on the assumption that a specific climate threat identified in the exposure analysis occurs.

During the works, a set of climate maps of Warsaw was prepared, presenting both the diversity of the city's climate components as well as the elements related to its vulnerability[23].

A number of city's features have impact on its vulnerability to climate change and its adaptation capability. Starting from the location, which is determined by the natural factors, from the landform features, the character of the natural vegetation, through the quality of soils or geological formations to be found in the ground, the quality of hydrographic (river) network, to man-made factors such as density, height and other properties of buildings, availability of municipal infrastructure, modifications to the terrain, plant cover, hydrographic network and others. The man himself, or rather the features of the population living in a given city, is also an element of the city's vulnerability. These may be people who are well informed, aware of the risks and acting responsibly in the face of a threat, or those who are unaware and unable to cope with crisis situations.

In order to assess these two elements which constitute Warsaw's specific characteristics in the face of climate change, i.e. its vulnerability and adaptability, the most important facts about the city were reviewed and divided into strengths demonstrating the adaptability of Warsaw and weaknesses demonstrating its vulnerability.

[22] In accordance with Podręcznik adaptacji dla miast – wytyczne do przygotowania Miejskiego Planu Adaptacji do zmian klimatu, Ministry of Environment, 2014.

[23] More to be found on the website adaptcity.pl and in section ADAPTCITY on the website mapa.um.warszawa.pl

Then, the strengths and the weaknesses were analysed by sector:

- human health and healthcare system,
- crisis management system
- public awareness,
- transport and communications,
- buildings and other enclosed structures,
- agriculture and forestry,
- Warsaw's nature system,
- energy sector,
- water and wastewater management,
- waste management.

**HIGH VULNERABILITY**

**The highest vulnerability** has been identified for the following sectors:

- health, buildings and network facilities, nature system and energy sector (energy supply) – in case of heat waves;
- public awareness, transport and communications infrastructure, buildings and water management – in case of heavy rainfall events (flooding);
- crisis management, transport and communications as well as buildings and network facilities – in case of floods;
- public awareness and agriculture and forestry as well as the city's nature system – in case of drought;
- public awareness, crisis management system and the city's nature system – in case of strong winds.

**HIGH ADAPTABILITY**

**The highest level of adaptability** has been identified for the following sectors:

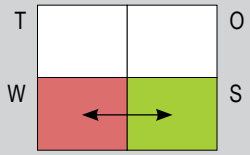
- transport and communications, the city's nature system and the energy sector – in case of heat waves;
- health, agriculture and forestry, the city's nature system and waste management – in case of flooding;
- crisis management, buildings and network facilities, nature system and water management – in case of floods;
- human health, crisis management and the energy sector – in case of drought;
- construction sector and network facilities – in case of strong winds.

### 3.2.3. Susceptibility Analysis

The next step was to show the interdependencies between the elements of the climate change TOWS analysis carried out for Warsaw.

It is not sufficient to determine the level of adaptability and vulnerability in case of threat for selected sectors. It is also required to examine to what extent the sectors' adaptability reduces their vulnerability level and then how these factors depend on the actual scale of climate threats. Revealing these interdependencies is the subject of the susceptibility analysis.

### Resilience assessment




Resilience assessment

The first part of the susceptibility analysis is the resilience assessment. Resilience is the difference between the vulnerability and the adaptability assessments. The resilience was low when high vulnerability was linked with low or medium adaptability. The resilience was described as medium when the levels vulnerability and adaptability were similar. The resilience was assessed as high when the level of adaptability was much higher than vulnerability.

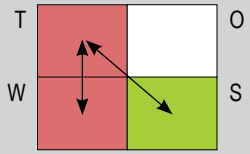
In order to create proper conditions for adapting Warsaw to climate change it is necessary to increase the city's adaptability and to reduce its vulnerability to the threats in the sectors where the diagnosis indicated low resilience.

**RESILIENCE ASSESSMENT LOW**

The low resilience diagnosis has been given for the following sectors:

- public awareness – with respect to high temperatures, rainfall and floods;
- transport and communications – with respect to rainfall, floods and strong winds;
- construction sector – with respect to high temperatures, rainfall and floods;
- nature system – in case of high temperatures, drought and strong winds;
- health and crisis management – in case of high temperatures;
- water and wastewater management – in case of heavy precipitation;
- agriculture and forestry – in case of drought.

## Susceptibility assessment




Susceptibility assessment

In order to produce an overall assessment related to the adaptation of Warsaw to climate change, the relationship between the city's exposure to climate change (threats) and its resilience (strengths and weaknesses) was analysed for individual sectors. These interdependencies constitute the susceptibility assessment.

The susceptibility assessment is a function of resilience assessment and exposure assessment. Susceptibility is high where high exposure coincides with low or medium resilience to a given threat. Susceptibility is described as medium if the exposure to a threat is at medium level and the resilience is medium or high. Susceptibility is low when the exposure level is low and resilience is high.

The susceptibility assessment for Warsaw has been made with respect to the threats the exposure to which has been assessed as medium (strong winds and drought) or high (floods, extreme temperature levels and rainfall). As a result of the analyses it has been established that for Warsaw to be able to adapt to climate change it is necessary to increase its resilience in the sectors where susceptibility to a given threat has been assessed as high.

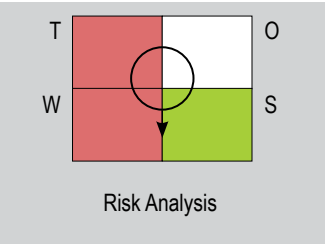
**SUSCEPTIBILITY ASSESSMENT**

**HIGH**

The high susceptibility diagnosis has been given for the following sectors:

- residents' awareness, transport and communications and construction sector – with respect to high temperatures, rainfall, floods and strong winds;
- nature system – with respect to high temperatures, floods, drought and strong winds;
- agriculture and forestry – in case of high temperatures, drought, precipitation and strong winds;
- crisis management – with respect to high temperature, rainfall and floods;
- health and energy sector – with respect to high temperatures, floods and strong winds;
- water and wastewater management – in case of floods and rainfall.

### 3.2.4. Risk Analysis



Risk Analysis

In the process of adapting Warsaw to climate change it is necessary to build the resilience to the identified threats, in particular for the sectors with high susceptibility. In order to ensure that the resilience is developed in a responsible manner, a risk analysis has been carried out to determine the scale and the probability of the negative impacts that the identified threats may bring. The analysis has shown which adaptation measures should be undertaken in the first place so as to avoid the most probable negative effects. Prevention and protection of the city against the most probable impacts should be treated as the most urgent, priority issue to address.

During the work, the sectors where divided into the following areas:

- Human life and health – sectors: healthcare system, crisis management and public awareness;
- Elements of technical infrastructure – sectors: construction, transport and communications;
- Green and blue infrastructure – sectors: agriculture and forestry and the Warsaw's nature system;
- Supplies of utilities for the city – sectors: energy, water management, waste management

For these areas the analysis was conducted concerning 5 most important threats identified during the exposure analysis, that is, heatwaves, flooding, flood events, droughts and strong winds.

**THE HIGHEST PROBABILITY IS ASSOCIATED WITH THE FOLLOWING THREAT IMPACTS:**

- Higher mortality or damage to health suffered by a number of people as a result of heatwaves;
- Single deaths and people harmed as a result of strong winds;
- Area-specific disruptions to the functioning of technical infrastructure and disruptions in utilities supply as a result of floods;
- Technical infrastructure failures as a result of heatwaves, flooding or strong winds;
- Spot damage to green infrastructure or small damage in larger areas of the city as a result of flood, drought or strong winds;
- Small spot damage to green and blue infrastructure as a result of flooding.

## 3.3. PRIORITY AREAS

Risk analysis by sector is not sufficient for a city covering a large area, such as Warsaw. It has been established that threats significant in one part of the city are not so important in another part. This applies, for instance, to the flood risk which covers about 25% of Warsaw's area whereas on the remaining area it is not very significant. It is expected that part of the adaptation measures will have to be implemented as a reaction to or protection against specific impacts occurring as a result of flooding, flood risk or occurrence of urban heat island effect. The risk analysis has been conducted on the basis of the assessment of the key climate change threats, thermal and hydrological (Fig. 9).

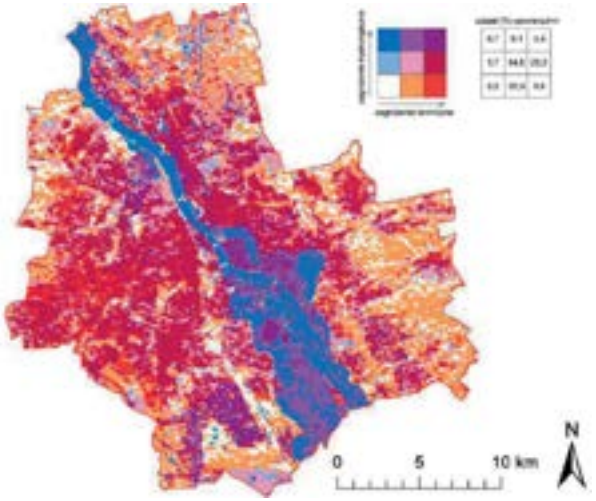



**Figure 9. Today's climate threats for Warsaw**

Source: Żmudzka E., Nelken K., Leziak K., Magnuszewski A., Lenartowicz M. „Mapa współczesnych zagrożeń klimatycznych m.st. Warszawy wraz z komentarzem", [Map of today's climate risks for the city of Warsaw woth a commentary] Warsaw, 2016 .

The threats[24] are spatially diversified, which is connected with density of development, landform, distance from water courses, etc. The biggest threats appear in densely built-up areas, situated relatively close to the Vistula riverbed – in the southern part of Praga-Północ and in the western part of Praga-Południe, in Żoliborz as well as in the eastern part of Mokotów, where there is a synergy between thermal and hydrological threats (mainly flood-related). The second area with high scale climate threats is Green Ursynów (the area west of the Puławska Street and the edge of the Kabaty Woods up to the border of the district), where hydrological threat is related to the risk of flooding after heavy rains and springtime snowmelt. The Vistula river valley stands out as an area of high hydrological threat but low thermal threat, which is connected with the impact of surface water on the local climate, reducing the thermal contrasts

In the western districts (Bemowo, Wola, Bielany, Włochy) there are small areas with high thermal threat (resulting from the high influx of solar energy converted into heat, the so called active surface) and low level of hydrological threat. In the districts with lower density of development and substantial share of green areas (part of Wawer, Wesoła, Białołęka) there are moderate climate threats, connected with the relatively low albedo of the active surface and no significant hydrological threat. More than 25% of the area of Warsaw lies within the zone of high thermal threat and moderate hydrological threat (for instance Targówek, northern part of Praga-Północ, Śródmieście, Ochota, Wola, Mokotów,

[24] The studies prepared for the purposes of the ADAPTCITY Project made it possible to carry out an overall assessment of the scale of thermal and hydrological threats. For each threat three classes were distinguished. Their combination resulted in showing the cumulative threat on a five-grade scale, from the highest to the very low threat. The list of studies used to make this assessment is included in the Bibliography.

Ursus). The thermal threat is connected mainly with the type of land cover and high temperature of the active surface; the hydrological threat – with the risk of local flooding as a result of heavy rainfall events. The areas with low climate threats are situated mainly on the outskirts of the city suburbs, surrounded by green spaces, with low-rise and dispersed development.

Taking into account the basic information about the exposure to climate threats[25] and the combination of thermal and hydrological threats, it is possible to describe the climate threat exposure by districts, divided into five groups.


[25] 14 types of climate threat information were analysed: impermeability, density of development, share of built-up and urbanized areas, albedo, greenspaces quality indicator, average temperature, coverage with biologically active surfaces, flood risk, number of warm nights, threat of local flooding, periods without precipitation, increase in the number of housing units, urban heat island effect and the share of greenspaces and forests. Then, an integrated classification was prepared for individual districts, dividing the climate threat into five categories, from the highest to the lowest.

## I. GROUP WITH MODERATE CLIMATE THREAT (194.9 KM2, 37.7% OF THE CITY AREA).

This Group includes the following districts: Wesoła, Rembertów, Wawer and Białołęka.

### Wesoła

This is a district with a substantial share of green spaces and forests. No significant increase the number of housing units is foreseen in these areas by 2030. At present and in future there are and will be a lot of permeable areas and the density of development is and will be low. The biggest threat is and will be posed by heavy rains that may cause local flooding. The district is situated outside the Warsaw's urban heat island. However, the fact that it is surrounded by coniferous forests, often growing on sandy soil, may be conducive to local, significant rise in temperature. The occurrence of at least two-week periods without rain that is twice as frequent in this district as in other parts of the city, may lead to plant wilting and breakouts and spreading of dangerous forest fires.

### Rembertów

This is a district with a substantial share of green spaces and forests. No significant increase in the number of housing units is foreseen in these areas by 2030. At present and in future there are and will be a lot of permeable areas and the density of development is and will be low, although slightly higher than in the Wesoła district. The biggest threat is posed by heavy rains that may cause local flooding. It is foreseen that short, heavy rainfall events may be more frequent than in other parts of the city. Rembertów is situated on the border of the Warsaw's urban heat island. What is particularly tiring for the residents is the occurrence of hot nights with temperature above 20°C, which do not allow people to rest and recover. In spite of the threat of heavy rainfall, the district experiences dry periods, at least two weeks without rain, twice as frequently as other parts of the city. In summer this may lead to plant wilting as well as to breakouts and spreading of dangerous forest fires.

### Wawer

In the Wawer district, the situation is similar to that in the districts of Wesoła and Rembertów, that is, green spaces and forests play an important role and the development of housing units (by 2030) is foreseen at a moderate level. At present as in future, there are and there will be a lot of permeable areas, the density of development is low and it may become moderate in future. The source of the biggest threat are heavy rains that may cause local flooding. Long periods without rain are typical for the Wawer area, whereas the rainfalls, when they occur, are intense. In addition, part of the district, including the built-up areas, is at risk of flooding from the Vistula River. The district is situated outside the Warsaw's urban heat island. However, the fact that it is surrounded by coniferous forests, often growing on sandy soil, may be conducive to local, significant rise in temperature. At the same time, the occurrence of at least two-week periods without rain that is twice as frequent in this district as in other parts of the city, may lead to plant wilting and breakouts and spreading of dangerous forest fires.

### Białołęka

The situation in the Białołęka district, where at present the threats are low, may change in future (by 2030), because of the forecasted intensive development of housing units, which may lead to significant increase of climate threat. First of all, as a result of the higher development density and the growth of impermeable area, the risk of local flooding will be greater. Currently, the biggest threat for Białołęka is flood on the Vistula River which may inundate a significant part of housing estates in Tarchomin and Nowodwory as well as those located further away from the river, towards Annopol and Brzeziny. Because of heavy rainfall, local watercourses such as the Długa River may also be a threat. The Białołęka district, currently classified within the group with moderate threat, may in future be shifted to the group of significant threat.

## II. GROUP WITH SIGNIFICANT CLIMATE THREAT (112.8 KM2, I.E. 21.8% OF THE CITY AREA).

This Group includes the following districts: Ursynów, Wilanów and Bielany.

### Ursynów

This is a district with a smaller area covered by green spaces and forests (compared to Group I) and with forecasted significant increase in the number of housing units by 2030, which in future may lead to higher climate threat. First of all, as a result of increased density of development and greater impermeable area the risk of local flooding will grow. In the northern part of Ursynów, the urban heat island effect exists. Some surfaces covered with concrete may heat up to more than 40° C. What is particularly tiring for the residents is the occurrence of hot nights with temperature above 20°C, which do not allow people to rest and recover. The large area of the Kabaty Woods has some heat mitigating impact. In the southern part of Ursynów there is a high threat of heavy rains which often result in local flooding.

### Wilanów

This is a district which, similarly to Ursynów, has fewer green spaces and forests (compared to Group I) and where significant increase in the number of housing units is forecasted by 2030. In future this may lead to higher climate threat, such as locally higher temperatures (local heat island) or to local flooding due to increased development density and larger impermeable area. In case of a catastrophic flood on the Vistula River, a substantial part of Wilanów may be flooded with a water column 2-3 m high. The district is also exposed to heavy rainfall. The risk is aggravated by the rising water of local watercourses, e.g. Potok Służewiecki, following heavy rains. Wilanów is situated outside the Warsaw's urban heat island.

### Bielany

Green spaces and forests play a great role in the Bielany district, but in spite of that, the district lies on the border of the Warsaw urban heat island. What is particularly tiring for the residents is the

occurrence of hot nights with temperature above 20°C, which do not allow people to rest and recover. In future, the situation may change for the worse because of the significant increase in the number of housing units forecasted by 2030, which will increase the climate threat. First of all, as a result of the growth in development density and larger impermeable area, the risk of local flooding will grow. Green spaces constitute an important element in the district's water management. They help to significantly delay the drainage of water after a heavy rain and by "retaining" water during hot periods, they substantially reduce the level of heat felt. The parts of Bielany district bordering the Vistula River are at risk of inundation during a flood event. These include mainly the Bielański Forest and the Młociński Forest.

## III. GROUP WITH STRONG CLIMATE THREAT (87.2 KM2, I.E. 16.8% OF THE CITY AREA).

This group includes the following districts: Targówek, Bemowo, Włochy and Ursus.

### Targówek

In this group, Targówek is the district with the lowest climate threat, where an important role is played by green spaces and forests, but this may change as a result of the significant development of housing units by 2030. First of all, as a result of the growth in development density and larger impermeable area, the risk of local flooding will increase. The most troublesome effect for the residents of Targówek, and especially Zacisze, may be local flooding following a heavy rainfall. Heavy rains also pose a risk of flood from local canals, especially the Bródnowski Canal. The district is situated within the limits of the Warsaw urban heat island and, as a consequence of the housing development, the heat island effect may intensify. Particularly tiring for the residents are hot nights with temperature above 20°C, which do not allow people to rest and recover.

### Bemowo

The situation in Bemowo is similar to Targówek, although the role of green spaces and forests is less significant. For the residents of Bemowo the most troublesome weather events are heatwaves. The district is situated on the border of the Warsaw heat island, which may extend and intensify as a result of the significant increase in the number of housing units forecasted by the year 2030. The areas covered tightly with concrete may heat up even to 40°C. Particularly tiring for the residents are hot nights with temperature above 20°C, which do not allow people to rest and recover. Thick greenery in housing estates as well as the numerous parks and squares help reduce the nuisance caused by these phenomena. i.

### Włochy

This is a district with a small share of green spaces and forests. An increase in the number of housing units is forecasted by 2030. Heatwaves are the weather event most troublesome for the residents. The district is situated on the border of the Warsaw's urban heat island. With the high sun exposure, the vast areas covered with warehouses and storage spaces heat up even above 40°C.

Particularly tiring for the residents are hot nights with temperature above 20°C, which do not allow people to rest and recover. Heavy rains cause serious problems leading to a threat of local flooding. Most of the rainwater drainage systems are based on absorbing wells which are not able to absorb huge amounts of water in a short time during an above-average rainfall event.

### Ursus

The Ursus district, similarly to the Włochy district, has a low percentage of green spaces and forests and by 2030 an increase in the number of housing units is forecasted. This may contribute to extension and intensification of the Warsaw's urban heat island effect, which is already present within the limits of the district. Some spaces in the post-industrial areas heat up to more than 40° C during hot weather. Particularly tiring for the residents are hot nights with temperature above 20°C, which do not allow people to rest and recover. In Ursus there is a high threat of heavy rains which may cause local flooding.

## IV. GROUP WITH HIGH CLIMATE THREAT (53.6 KM2, I.E. 10.4% OF THE CITY AREA).

This group includes the following districts: Mokotów, Żoliborz and Ochota.

### Mokotów

The Mokotów district's exposure to negative impacts of climate change and extreme weather events varies. The Upper Mokotów lies within the limits of the Warsaw's urban heat island and therefore heatwaves may be the most troublesome for the residents there. Particularly tiring are hot nights with temperature above 20°C, which do not allow people to rest and recover. In future, Mokotów may be in a difficult situation because of the little role played by green spaces and forests and the forecasted significant increase in the number of housing units by 2030. First of all, as a result of the growing density of development and larger impermeable area, the risk of local flooding will grow. Floods pose the greatest threat to Lower Mokotów. In case of a catastrophic flood on the Vistula River, almost the entire area may be flooded with a water column 2-3 m high. The threat is aggravated by the rising water of local watercourses, e.g. Potok Służewiecki, following heavy rains.

### Żoliborz

For the residents of the Żoliborz district the most troublesome may be the heatwave events. The district is situated on the border of the Warsaw urban heat island. Particularly tiring are hot nights with temperature above 20°C, which do not allow people to rest and recover. Thick greenery at the housing estates as well as numerous parks and squares help to reduce the nuisance caused by these phenomena. Żoliborz is a district with high percentage of impermeable areas. In future, Żoliborz, similarly to Mokotów, may find itself in a difficult situation because of the significant increase in the number of housing units by 2030. It is the area with the heaviest short-term rainfalls which lead to local flooding.

### Ochota

Ochota is situated in the centre of the Warsaw urban heat island, therefore heatwaves may be the most troublesome phenomenon for the residents. During the hottest days the temperature in Ochota may be 6 degrees higher than outside the city. Particularly tiring are hot nights with temperature above 20°C, which do not allow people to rest and recover. Ochota is a district with high percentage of impermeable areas, which cover more than 70% of the district's surface. Such a situation aggravates the heat and contributes to excessive accumulation of rainwater in undesirable places on the surface, leading to local flooding. In future the situation may deteriorate because of the little role played by green spaces and forests and the forecasted significant growth in the number of housing units by 2030.

## V. GROUP WITH THE HIGHEST CLIMATE THREAT (68.7 KM2, I.E. 13.3% OF THE CITY AREA).

This group includes the following districts: Praga-Południe, Praga-Północ, Wola and Śródmieście.

### Praga-Południe

The Praga-Południe district, and especially Saska Kępa and Gocław, is the area with high threat of floods. In case of a catastrophic flood, the area may be inundated by a water column 3 m high, and the cubature of the flooded buildings may exceed 1 million m3. In the part of Warsaw on the right bank of the Vistula River, the centre of the urban island effect is located near Rondo Wiatraczna. Particularly tiring are hot nights with temperature above 20°C, which do not allow people to rest and recover. The small percentage of green spaces and forests makes the situation even worse. An increase in the number of housing units is forecasted in the area by 2030.

### Praga-Północ

The Praga-Północ district, and especially its centre and the area surrounding the ZOO, is the area with higher threat of flood. In case of a flood event, the area may be hit by a water column from 0.5 to 2 m high, and locally reaching even 4 m. Praga-Północ is situated within the limits of the Warsaw urban heat island. During the hottest days, the temperature in Praga-Północ may be 4-5 degrees higher than outside the city. The post-industrial and residential areas heavily covered with concrete (61% of the district's area) may heat up to more than 40° C. Particularly tiring are hot nights with temperature above 20°C, which do not allow people to rest and recover. The small percentage of green spaces and forests makes the situation even worse. An increase in the number of housing units is forecasted in the area by 2030.

### Wola

In the Wola district the climate threat is very high, with the role of green spaces and forests assessed as moderate and a significant increase in the number of housing units is forecasted by 2030. In future this may lead to increased climate threat exceeding the current levels. First of all, as a result of the higher development density and the growth of impermeable area the risk of local flooding will increase. Wola is situated at the centre of the Warsaw urban heat island and therefore heatwaves may be the most troubleso-

me weather events for the residents. During the hottest days the temperature in Wola may be 5-6 degrees higher than outside the city. Particularly tiring are hot nights with temperature above 20°C, which do not allow people to rest and recover. Wola is a district with high percentage of impermeable areas, which cover almost 70% of the district's surface. This aggravates the heat and contributes to excessive accumulation of rainwater in undesirable places on the surface, leading to local flooding.

### Śródmieście

Śródmieście district is the area with the highest climate threat in Warsaw. This is caused by little number of green spaces and forests. However, by 2030 no significant increase in the number of housing units is forecasted. Śródmieście is situated at the centre of the Warsaw urban heat island therefore heatwaves may be the most troublesome phenomenon for the residents. During the hottest days, the temperature in Śródmieście may be 6 degrees higher than outside the city. Particularly tiring are hot nights with temperature above 20°C, which do not allow people to rest and recover. Śródmieście is an area with high share of impermeable surfaces – almost 70% of the district's area. The quick drainage of water from such areas during rain often leads to local flooding that may affect especially the Powiśle area, which is also vulnerable to flood risk.

## 3.4. ADAPTATION OPTIONS

The adaptation options provide a response to the identified climate change threats. They include suggestions of possible actions to address a particular climate threat. The implementation horizon has been set at the year 2050 (assuming that there will be no changes to the present analyses), which is a reference point for the assessment of the measures currently applied to adapt Warsaw to climate change. The maximum version of the plan consists of 5 sets of measures.

**PACKAGE 0 Awareness**

The package comprises adaptation options ensuring the swift implementation of Packages 1-5, which aim to adapt the City to climate change and minimise its impacts by preparing the public (education), creating appropriate information and warning systems as well as establishing appropriate structures and ensuring cooperation.

Examples of measures to be adopted under Package 0:

- To create a coherent system for early warning against regional threats,
- To create coherent systems for informing the residents about threats,
- To educate various age, social and professional groups about climate change and adaptation
- To conduct joint information campaigns about climate change, including threats and adaptation measures
- To create a uniform brand for the actions related to climate change and adaptation,
- To cooperate at the local, national and international level on climate change adaptation
- To cooperate with non-governmental organisations and promote grass-root initiatives related to climate change adaptation.

**PACKAGE 1 Heat**

The package comprises adaptation options aiming to combat the increased mortality during hot weather periods and reduce the range of the urban heat island effect.

Examples of measures to be adopted under Package 1:

- To develop a system for monitoring the urban heat island effect,
- To control the effect and the shape of the urban heat island,
- To ensure proper airing and ventilation of the city, including protection of the ventilation corridors,
- To create urban infrastructure that improves/facilitates the functioning of people and animals in the city during periods with high temperature, e.g. construction of fountains, water curtains and drinking water fountains, etc.,

- To create or ensure easy/universal access to cooling oases, e.g. by appropriate air-conditioning systems, green spaces, shaded spaces with benches, places with access to water – e.g. urban beaches and bathing water areas, including access to drinking water – e.g. drinking water fountains, etc.,
- To apply green areas maintenance methods that do not disturb the function performed by plants, that is, the reduction of the ambient temperature,
- To create and support the development of the infrastructure that contributes to cooling the environment, such as green roofs and walls as well as other vertical green structures, to promote among the residents the idea of creating "balcony gardens",
- To protect the existing green areas and increase their share in the overall city area, including small green belts, squares, pocket parks,
- To provide access to as many green areas as possible,
- To increase the share of biologically active areas by reducing impermeable surfaces, e.g. by desealing the impermeable surfaces,
- To promote and introduce solutions that adapt buildings to climate change,
- To protect highly vulnerable groups (elderly people, sick people, children) from heat,
- To protect the existing green areas, in particular, trees and places surrounding them,
- To introduce a system for monitoring trees in the city,
- To extend green spaces adjacent to streets,
- To improve the thermal comfort of the passengers waiting for public transport (including green stops, shaded areas, cool enclaves).

**PACKAGE 2 Wind**

The package comprises adaptation options aiming to combat the increased mortality and damage caused by strong winds.

Examples of measures to be adopted under Package 2:

- To introduce a system for taking stock of the green spaces and for monitoring of trees in the city and a permanent programme for tending to / replacement of trees,
- To introduce protected zones around old trees (heritage trees),
- To create warning systems and to introduce a ban on entry/to issue warnings against entry to parks, forests during high wind,
- To conduct educational, information and promotional campaigns focused on improving knowledge about rules of maintaining green spaces, particularly trees, in good condition.

**PACKAGE 3 Water**

The package comprises adaptation options aiming to eliminate the damage related to the variability of water flow of the Vistula River, including both floods and excessively low water level as well as the development of the riverside areas.

The Package also includes adaptation options designed to eliminate the damage caused by heavy rainfalls, floods caused by smaller watercourses in the city bursting their banks and by local flooding.

Examples of measures to be adopted under Package 3:

- To protect, modernise and construct hydrotechnical and land improvement facilities,
- To maintain the adequate discharge capacity at the so called "Warsaw corset" [the narrow section of the Vistula riverbed] – a pinch point on the Vistula River,
- To maintain proper flood defence infrastructure and preparedness of emergency services, to move the sensitive infrastructure away from the flood plains,
- To improve the critical public infrastructure on flood plains,
- To create water retention systems in the city – to regenerate and upgrade water reservoirs and green spaces in order to improve retention capacity, to protect, restore and create water retention areas, to develop a system of micro water retention, to adapt areas with other functions to perform the retention function temporarily,
- To apply green areas maintenance methods that do not disturb the water retention function performed by plants,
- To prepare guidelines in order to enforce natural groundwater retention in the city by preventing sealing and overdrying of the ground,
- To apply systemic management of rainwater, including management of rainwater at source (to promote solutions using permeable surfaces, de-sealing of impermeable surfaces).

**PACKAGE 4 Infrastructure**

The Package groups all the options to prevent damage to technical infrastructure as a result of extreme weather events, such as heatwaves, local flooding and strong winds and to adapt the infrastructure to climate change.

Examples of measures to be adopted under Package 4:

- To introduce solutions that increase the city's energy independence, including increased share of renewable energy,
- To put overhead power lines underground in the sites particularly exposed to high winds,
- To replace and modernise power grid infrastructure,
- To apply rainwater collection solutions,
- To place various forms of greenery within the transport system as well as facilities for retention of rainwater and slowing down the surface drainage,
- To apply solutions protecting the infrastructure from extreme weather events,
- To improve the standards of buildings and premises as well as the surrounding space.

**PACKAGE 5 Green spaces**

The package consists of adaptation options aiming to protect the city's nature system from the consequences of drought, local flooding.

Examples of measures to be adopted under Package 5:

- To apply a systemic approach to developing elements of green and blue infrastructure,
- To create systems for protection of the existing green infrastructure areas and to increase their surface,
- To create a system for calculation and taking account of opportunity costs related to city investment projects that have adverse impact on urban green areas,
- To transform degraded land into green spaces, especially around buildings,
- To create systems for the protection of the existing and the creation of new elements of blue infrastructure,
- To take proper care of the green infrastructure before and during dry weather periods,
- To collect and use rainwater to water the plants,
- To involve residents in the system of urban green spaces maintenance,
- To use new (more drought resistant) species for new planting, to deploy systems for irrigation of urban green spaces during drought,
- To make a valuation of the ecosystem services.

# 4. ADAPTATION OF WARSAW TO CLIMATE CHANGE

## 4.1. PRIORITY AND RULES

In spite of the efforts of the international community, climate change is progressing. For Warsaw and its residents it means the growing threat of a greater number and intensity of extreme weather events, primarily heatwaves, drought, strong winds, flood events and local flooding. Considering this, the members of the Warsaw Round Table for Adaptation to Climate Change (WOSAK)[26] proposed that the city of Warsaw and its residents should be guided by the following motto:

**WARSAW – A COMMUNITY ACTING RESPONSIBLY IN THE FACE OF CLIMATE CHANGE.**

The following PRIORITY has been adopted:

**TO PREPARE WARSAW TO THE IMMINENT CLIMATE CHANGE, MAINLY BY MITIGATING ITS IMPACTS AND ENSURING SMOOTH FUNCTIONING OF THE CITY WITH ACCEPTABLE COSTS FOR ECONOMY, SOCIETY AND NATURE.**

The rules by which the authorities, the residents and the entrepreneurs of Warsaw should be guided are the following:

1) The authorities of Warsaw, when preparing planning documents, especially those pertaining to spatial development and adoption of the city budget, shall take into consideration the need for action aimed at adaptation to climate change and its consequences;

[26] Warszawski Okrągły Stół ds. Adaptacji do Zmiany Klimatu, known as WOSAK [Warsaw Round Table for Climate Change Adaptation] was convened by Mayor of Warsaw and comprised representatives of non-governmental organisations, academia, Warsaw City Hall and the entities providing services for the residents of the city. The aim of WOSAK was to enable cooperation between the local government, academia, non-governmental and business communities on preparing the Climate Change Adaptation Strategy for the City of Warsaw. It was an advisory body that prepared recommendations on the directions and the manner of implementing the Strategy.

2. When undertaking investment or procurement activities (wherever it is justified) the need for climate change adaptation action shall be considered and the standards and norms resulting from future climate conditions shall be applied;

3. The Warsaw administration shall introduce model solutions aimed at adaptation to climate change and its consequences;

4. The needs of the emergency services shall be the priority in Warsaw, both in developing spatial development solutions and in the management of individual facilities;

5. Individual areas of Warsaw (according to their local specificity) and social groups (according to their vulnerability) shall be given equal treatment from the point of view of adaptation action;

6. Information about climate change, its consequences and the meteorological data shall be collected in a uniform manner and shall be fully available for the services and entities managing the climate risk; the information and the data shall be also relayed to the population and the business community of Warsaw in a clear manner – the threats shall not be concealed;

7. In Warsaw, the authorities, the local communities and the business community shall regularly conduct educational activities to inform about climate change threats and their consequences according to the following principle: see, touch, understand, act; every important activity in the city aiming to protect the climate or adapt to climate change shall be used as an opportunity to educate and inform the residents in order to raise their climate awareness;

8. Conditions shall be created for local activism and strengthening the self-organisation and self-sufficiency (using the social capital) in the face of the appearing threats;

9. The areas of Warsaw and the places exposed to high climate change risk must be covered by contingency plans developed with the participation of the public;

10. Because of the specific nature of climate change and its consequences, Warsaw shall be guided by the following rules when dealing with vital detailed issues:

- During the hot season, measures shall be applied to reduce the heat entering building structures whereas in the cold season the escape of heat from building shall be prevented;
- Rainwater shall be properly managed, in particular, it should be managed where generated;
- Green and blue infrastructure shall be preserved, strengthened and developed as much as possible with reference to the concept of ecosystem services.

The following should be done in order to reduce the threats to Warsaw while following the above mentioned rules:

1. To ensure the possibility of safe management or collection of water in Warsaw;

2 To ensure operation of the technical infrastructure and supplies in Warsaw in case of extreme weather events;

3 To ensure that human health and lives are protected in case of extreme weather events – mainly heatwaves, floods and heavy rains and sanitary and epidemiological threats related to them;

4 To support responsible local activities preventing and removing the impacts of extreme weather events, particularly strong wind.

## 4.2. LINES OF ACTION

**I. TO ENSURE CONSISTENT IMPLEMENTATION OF MEASURES THAT WILL GUARANTEE WARSAW'S ADAPTATION TO CLIMATE CHANGE.**

In order to maximise the resilience of the city to climate change it is necessary to ensure that activities undertaken by Warsaw, in all areas, take into account the climate change aspect. For a successful outcome it is particularly important to develop the city space in a manner that takes account of the need to adapt to these changes. Therefore, when preparing development programming documents, both at the strategic and the executive level, the threats that the city will have to face must be considered. With appropriate action, the consequences will certainly be mitigated and the smooth functioning of the city will be ensured. For Warsaw, it is especially important is to draw attention to the development of areas at risk of flood as well as construction of systems to control the water flow. This problem should be viewed from the point of view of the infrastructure, bearing in mind the social aspect.

In particular, the following actions should be undertaken:

- To monitor climate change and collect data about threats,
- To optimise the system for coordination of the adaptation process,
- To make the adaptation process more coherent, in particular, by ensuring that provisions included in the Warsaw development programming documents, planning and financial documents are consistent,
- To ensure that the Warsaw development programming, planning and financial documents take account of the climate change adaptation requirements relevant to the appearing threats.

## II. TO ENSURE COOPERATION IN THE FIELD OF CLIMATE CHANGE ADAPTATION AT THE LOCAL, REGIONAL AND NATIONAL LEVEL.

Extreme weather events occurring as a result of climate change do not need to originate inside Warsaw in order to have negative impact on the city. What is more, they are not limited to the city administrative boundaries but often cover wider areas. That is why Warsaw must seek to establish cooperation at both the local as well as regional and national levels. It is necessary to develop mechanisms for communication and access to information as well as to create common programmes and undertake joint action. To ensure security it is necessary to optimise the system whereby the city administration and the residents work together with emergency and law enforcement services.

It is important to build cooperation with the residents of Warsaw and with the neighbouring local communities, including local authorities, and to foster common education and experience/ good practices sharing with regard to spatial interdependence of climate change-related extreme weather events.

In order to eliminate or reduce the negative impact of extreme weather events it is necessary to ensure proper functioning of the links between the green and the blue infrastructure on the area much larger than just the area of Warsaw. This is one of the reasons why Warsaw, apart from the above mentioned cooperation, should engage in joint activities with administrative institutions, non-governmental organisations or entrepreneurs, both at the local (metropolitan) and national level and at the international level.

In particular, the following should be done:

- To form and optimise a system of joint cooperation,
- To develop channels for efficient communication between the stakeholders for the purpose of collecting data and exchanging information about the occurrence of adverse weather events and their consequences, within the framework of various data collection systems: local, regional and national,
- To create a platform for exchange of information, experience, good practices concerning adaptation activities and their effectiveness,
- To implement systemic solutions that enable participation of the entities responsible for green areas maintenance in the design and construction works related to infrastructure projects,
- To develop and implement common procedures, warning and information systems in case of the occurrence of extreme weather events and their consequences,
- To conduct joint workshops, exercises and training courses for local government administration, the institutions monitoring the environment and the services, guards and inspectorates as part of crisis management.

## III. TO RAISE AWARENESS OF HOW TO BEHAVE IN THE FACE OF CLIMATE CHANGE

In order to improve the security of the residents and ensure proper quality of life it is particularly important to develop the society that is well informed and responsible for the decisions and choices it makes. It is necessary to foster attitudes of caring for one another, e.g. by building civic and social competencies, both among residents and administration officials. One of the tools to achieve the desired results is to educate the society and the Warsaw city administration, as well as the entities in charge of spatial planning, provision of utilities and security, about the nature and scale of the threats related to extreme weather events and to create a system of information about extreme weather events and the appropriate conduct when they occur.

In particular, the following should be done:

- To keep raising the awareness and understanding of climate change among the residents in order to improve their ability to respond to the risk,
- To educate the public about the impacts of climate change, adaptation actions and response when the threat occurs,
- To ensure regular access to information about the possible threats and the way to respond to them,
- To promote and inform the stakeholders about the climate change adaptation activities,
- To provide specialist education focused on improving awareness, skills and knowledge, especially among administration officials, decision makers, municipal services, planning specialists, urban planners, architects,
- To raise awareness of local governments within the Warsaw Metropolitan Area about spatial interdependence of climate change-related extreme weather events,
- To develop pilot preventive projects as elements of education and good practices building,
- To introduce a system of prohibitions, recommendations and restrictions related to risks (such as a ban on entry into forests because of fire risk, restrictions in the use of water at the time of water deficit, prohibition on entry into parks or cemeteries in case of strong winds), as an element of education on threats and risks.

## IV. TO IMPROVE WARSAW'S RESILIENCE TO CLIMATE CHANGE

In order to ensure that Warsaw's resilience reaches the adequate level, it is necessary, in particular, to attach the same importance to the green and the blue infrastructure as to the technical infrastructure and the built-up areas. The green and blue infrastructure is, on the one hand, a tool for mitigating and adaptation to climate change, on the other hand, it is threatened by this phenomenon and requires protection from extreme weather events. The current change in the approach to this infrastructure makes it also necessary to draw attention to the need to ensure the provision of ecosystem services in the context of climate change and extreme weather events. This applies in particular to such services as the conditions for the provision of high quality food, provision of drinking water, climate regulation and protection from natural threats, soil erosion control or recreational spaces.

In particular, the following should be done:

- To strengthen the role of the green and blue infrastructure,
- To adapt the water management system, in particular, to improve biodiversity and retention capability of green spaces while increasing their overall area, to restore the retention capability of impermeable surfaces, to create infrastructure capable of retaining water on site,
- To improve the resilience of technical infrastructure to extreme weather events and to ensure its efficient operation and the provision of utilities to the city when such extreme weather events occur,
- To take action to reduce the severity of extreme weather events and their impact on the health and life of the residents,
- To adapt the social infrastructure so as to ensure security to all those who need it in case of extreme weather events.

## 4.3. ADVANTAGES OF TAKING ACTION TO ADAPT TO CLIMATE CHANGE

The implementation of the guidelines set out in this document will enable the management of climate risk in Warsaw by 2030 and after that date. The adaptability of the entire city as well as that of the individual districts, households, businesses and institutions will improve as will the adaptation capability of the residents and civil society organisations.

It will contribute to a significant improvement of the quality of life in the city and will help protect the residents' health. The process of Warsaw's adaptation to climate change will undoubtedly make the city more competitive, it will help to develop the labour market, to create attractive and safe spaces, will improve the quality of the environment and introduce more effective mechanisms for its protection. It will also result in creating demand for modern technology and innovative solutions in Warsaw.

A lot of the solutions adapting the city to climate change will be multi-functional in character and will be developed together with the residents of Warsaw in the process of co-designing and co-creating, thus enabling the use of the social capital built in the process.

It will also impact on the rise of awareness, knowledge gathering and information exchange as well as the ability to implement adaptation measures improving the resilience of the city and its infrastructure. In particular, it will contribute to **ensuring the security of the residents and to avoiding losses or increasing the ability to quickly restore functioning of the city**, its residents and businesses, in case of negative impacts of climate change.

**EXPECTED DIRECT BENEFITS**

- Increased biodiversity, leading to ecological added value for the city and strengthening of the ecosystems providing ecosystem services to the city and its residents.
- Improved security and better health protection as well as comfort and quality of life for residents.
- Increased public awareness and engagement of residents.
- Reducing financial and material losses.
- Improving the city's competitiveness and creating new jobs.

# 5. GUIDELINES FOR IMPLEMENTING DOCUMENTS

## 5.1. LINKS TO THE WARSAW DEVELOPMENT PROGRAMMING DOCUMENTS

The document plays the role of a policy paper for the Strategy #Warszawa2030 and sets out the principles and guidelines for the urban programmes for climate change adaptation.

The issues presented in the Climate Change Adaptation Strategy for the city of Warsaw by 2030 with the prospects until 2050, because of their specific nature, are linked with a number of areas, both social and economic, as well as the area of nature. It covers a range activities, from "soft" ones (educational, informational, organisational) to "hard" ones (investment, technology), touching upon practically all areas of the city's functioning. For Warsaw to adapt to climate change, it is necessary to ensure that the documents programming the city's development are consistent and to make sure that projects are implemented in accordance with the established adaptation action lines. It is important to ensure that the preparation of the programmes for achieving the operational objectives of the Strategy #Warszawa2030 is realised taking account of the principles and guidelines set forth in this document as well as in cooperation between the individual areas.

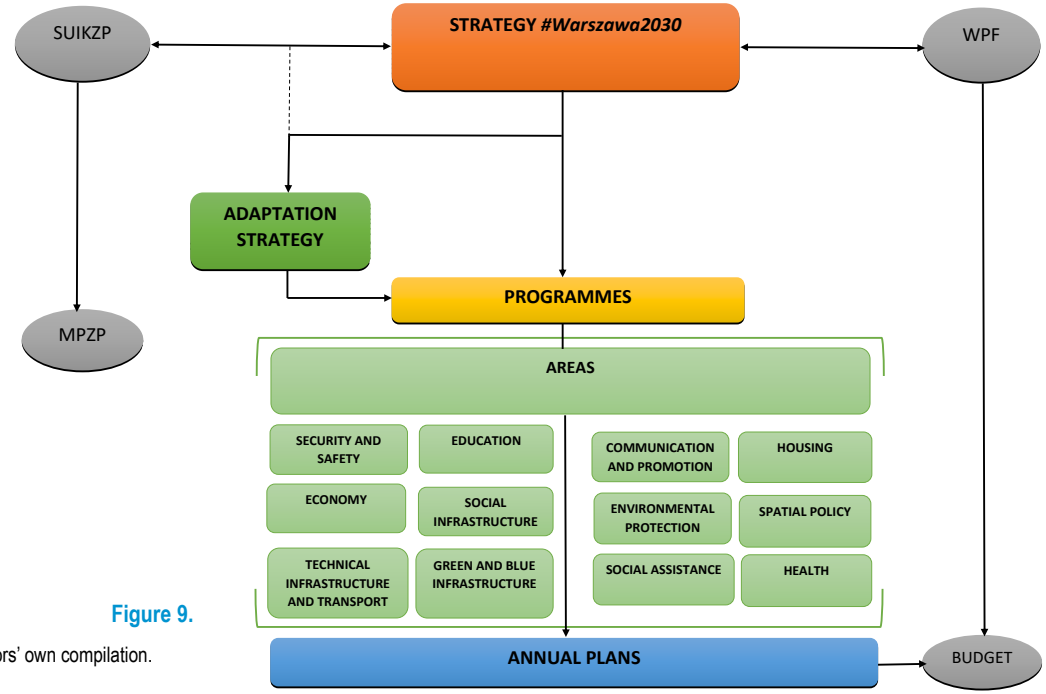



Figure 9.

Source: Authors' own compilation.

## 5.2. LINKS TO THE PLANNING DOCUMENTS

As the analyses conducted as part of the ADAPTCITY project show, the main climate change-related threats for Warsaw are thermal threats (the urban heat island effect) and hydrological threats (local flooding following heavy rainfall and floods). At the same time, the work adapting the city to climate change should be linked with the measures to reduce the emission of greenhouse gases.

In order to achieve the appropriate effects it is necessary to ensure the proper correlation between the strategic and the planning documents. The shaping of the spatial planning policy in a manner that protects the city from the negative impacts of climate change is a necessary condition for the success of the entire enterprise. That is why spatial planning is a very important tool in mitigating the impacts of climate change and implementing adaptation mechanisms; it also guarantees that the right microclimate is created in the city.

The inclusion in the spatial planning of the guidelines for the adaptation of the city to climate change will make it possible to reduce the consequences of climate threats. Such use of spatial planning is based primarily on applying the basic instruments of spatial planning, such as determination of the land use or ensuring coherent use of various environmental forms in a given area, which will enable informed management of spatial resources. Thanks to spatial planning it is possible to specify the function of a given area and thus prevent it from being managed in an inappropriate way, and limit the range and influence the shape of the heat island. Sustainable development, protection of open and green spaces and local management of rainwater are particularly important. It is necessary for planning documents to take account of the results of the monitoring of urban heat island effect and the results of the analyses that provide information about the potential threat of flooding and the risk of flood from the Vistula River.

## 5.3. STRATEGY IMPLEMENTATION

The process of the adaptation of Warsaw to climate change, consistent with the direction set out in the Adaptation Strategy is supervised by the Mayor of Warsaw supported in this task by the Climate Protection Team[27]. The coordination of the adaptation process is the responsibility of the bureau nominated by the Mayor of Warsaw to perform, among others, the following tasks:

- To cooperate in creating programmes and annual plans for the areas related to climate change adaptation,
- To monitor climate change and to assess its impact on the city, including a diagnosis of the city ecosystem's resilience to climate change,
- To evaluate the Climate Change Adaptation Strategy for the city of Warsaw,
- To perform the reporting tasks in connection with the adaptation process,
- To update, on the basis of the analysis and assessment of the progressing climate change, the lines of action necessary to minimise the costs resulting from the damage caused by extreme weather events and the need to ensure security and comfort of life to the residents,
- To study the adaptation awareness and needs among the city's residents and selected city administration units.

The Climate Change Adaptation Strategy for the city of Warsaw is a horizontal document, which means that it requires coherent action on the part of all entities responsible for individual areas of the functioning of the city. The Adaptation Strategy will be implemented via implementing documents. The principles and the lines of action included in this document shall constitute the guidelines that should be taken into account during the development of all the implementation documents in Warsaw, including the programmes that describe in detail the implementation of the operational objectives of the Strategy #Warszawa2030 or other mandatory tasks of the city. Thus the entities preparing and implementing the programmes are the direct implementers of the provisions of the Adaptation Strategy.

The programmes of the operational objectives of the Strategy #Warszawa2030, which should, in particular, include the guidelines of the Adaptation Strategy have been presented in Table 3 below.

[27] Regulation No. 1823/2008 of the Mayor of Warsaw dated 7 July 2008 on appointing the Climate Protection Team, as amended.

**Table 3. Programmes for the operational objectives of the Strategy #Warszawa2030 that are particularly important for the process of Warsaw's adaptation to climate change, pursuant to the Climate Change Adaptation Strategy for the city of Warsaw by 2030 with the prospects until 2050.**

| Operational Objective Programmes | Unit within the Warsaw City Hall responsible for the preparation and implementation of the operational objective programme |
|---|---|
| 1.1. We care for one another | Bureau responsible for strengthening local communities |
| 1.2. We decide about our city together | Bureau responsible for development of civil society |
| 2.1. We can access a wide housing offer | Bureau responsible for housing policy |
| 2.3. We use services close to home | Bureaux responsible for the policies:<br>• educational,<br>• social welfare,<br>• health |
| 3.1. We take advantage of attractive public space | Bureau responsible for spatial policy |
| 3.2. We live in clean natural environment | Bureau responsible for environmental protection policy |
| 3.3. We use a friendly transport system | Bureau responsible for transport policy |
| 4.1. We develop our creative potential | Bureau responsible for educational policy |
| 4.2. We generate innovation | Bureau responsible for economic policy |
| 4.4. We inspire the world | Bureaux responsible for the policies:<br>• economic,<br>• educational. |

Source: Authors' own compilation.

## 5.4. MONITORING AND EVALUATION

### Monitoring

In order to optimise the process of Warsaw's adaptation to climate change, ongoing monitoring of climate change and assessment of its impact on the city will be conducted, including a diagnosis of the resilience of the city's ecosystem to climate change.

In addition, the indicators adopted in individual programmes will be used to monitor the implementation of the Adaptation Strategy provisions.

Reports concerning the level of implementation of measures adapting the city to climate change will be prepared in a three-year cycle by the bureau responsible for the coordination of the adaptation process in the city.

### Evaluation

In order to assess the relevance, effectiveness, sustainability, efficiency and usefulness of the actions adapting Warsaw to climate change, evaluation studies will be carried out.

Ongoing evaluation will be conducted to assess whether the actions undertaken so far have been implemented in accordance with the adopted Adaptation Strategy guidelines, whether they bring the expected effects, and whether they are adequate to the threats resulting from the constantly changing climate.

In particular, the results of the monitoring of the implementation of adaptation activities contained in individual programmes, as well as the monitoring of climate change and the assessment of its impact on the city will be used for evaluation purposes.

The results of the on-going evaluation will make it possible to introduce appropriate adjustments to the programmes and the guidelines included in the Climate Change Adaptation Strategy for the city of Warsaw. In addition, on the basis of the evaluations, a decision may be taken concerning the need to update this document.

It is also planned to carry out a final ex-post evaluation in order to make a comprehensive assessment of the effects of including the Adaptation Strategy guidelines in the implementing documents.

The evaluation studies will be conducted by the bureau responsible for the coordination of the adaptation process in the city.

# GLOSSARY OF TERMS

**Climate change adaptation** – according to the United Nations, it is the adaptation to changes in the ecological, social and economic systems in response to the actual or expected climate changes and their effects or impact. This applies also to modification of processes, practices and structures that lead to reducing possible losses and to using the opportunities related to climate change.

**Albedo** – the ratio of the radiation reflected to the radiation received; it describes the ability of a given surface to reflect radiation.

**Very hot days** – days with temperature above 30°C.

**Supply of utilities and food to the city** – supply of utilities such as electricity, heat, gas, water or disposal of wastewater and solid waste, ensuring proper functioning of the city as well as the provision of the appropriate quantity and quality of food products.

**Extreme weather events** – violent and intense precipitation, strong winds, heat waves, thunderstorms, storms, tornadoes, hailstorms, etc.

**Heatwaves** – continuous sequence of at least 3 days when the average maximum temperature reaches at least 30°C; that is, during such period there are both very hot days (with maximum temperature above 30°C), and hot days (with maximum temperature above 25°C), with two conditions that must be met: 1) the number of very hot days should exceed or at least equal the number of hot days, 2) the sequence of hot days between the very hot days may not exceed three.

**Global climate warming** – a phenomenon related to the increasing concentration of greenhouse gases in the atmosphere, such as carbon dioxide, methane or nitrous oxide. Global warming is the increase in the natural greenhouse effect. The essence of the effect is that greenhouse gases found in the atmosphere let through the sun radiation, which heats the Earth, but retain the long-wave thermal radiation emitted from the Earth's surface. The captured thermal radiation heats the Earth's atmosphere, and the rest of it flows into space. The increased concentration of greenhouse gases in the atmosphere means that a greater proportion of the long-wave radiation is directed back to the planet's surface. Greenhouse gases form a heat trap that works just like a greenhouse. Without greenhouse gases, the Earth's average temperature would be about 33°C lower, i.e. -18°C, while it is currently +15°C.[28]

**Technical infrastructure** – pursuant to the Act dated 21 August 1997 on real property management (Journal of Laws of 2018, item 2204), technical infrastructure facilities shall mean roads and water supply, sewage, heat distribution, electric, gas and telecommunications pipework, cables, facilities and fittings, built under ground, over ground or above the ground.

**Green and blue infrastructure** – a network of nature-related links which has a positive effect both on the conditions of life in a city and on the city's nature environment. It includes green spaces, e.g. parks, squares, landscaped greens, street greenery, green roofs and walls as well as water resources such as rivers, streams, ditches, lakes and water reservoirs, marshes and various solutions for rainwater management.

**Housing unit (number)** – number of flats in a selected period in selected areas

**Urban heat island effect** – a phenomenon that occurs in urban areas, where temperature in the city is higher than in the surrounding area. It concerns, in particular, centres of densely built-up

[28] A. Arcipowska, A. Kassenberg, Małe ABC... ochrony klimatu, Institute for Sustainable Development, Warsaw 2007.

cities, without green areas and water courses or water reservoirs. High daily and annual variability is characteristic of urban heat island effect, it also occurs more frequently in summer than in winter. The biggest differences in temperature occur during clear, cloudless nights, when the heat captured in the city during the day is released.

**Intergovernmental Panel on Climate Change (IPCC)** – a team of climate scientists conducting assessment studies on the basis of which governments and international organisations may initiate action and set policy frameworks to counter climate change. IPCC was established in 1988 by the World Meteorological Organization and the United Nations Environment Programme, to assess the risk related to human impact on the climate. Since 1989, IPCC has been regularly preparing reports on the present and forecasted changes of the climate. The Fifth Assessment Report, AR5, was published on 2 November 2014. The Special Report on Global Warming of 1.5 °C was released on 8 October 2018.

**Tropical nights** – nights during which air temperature does not fall below 20oC.

**Resilience of the city to climate change** – ability of the city to prepare for the threats related to extreme weather events while maintaining proper functioning of the city.

**The Covenant of Mayors** – the biggest initiative of city authorities in the world concerning energy and climate, grouping representatives of almost 8 thousand local and regional authorities which voluntarily implement the European climate and energy objectives in their areas and implement the integrated programme for mitigating climate changes and adapting the cities to their impacts[29]. Warsaw has been a member of the Covenant since 2009.

**Biologically active surface** – native soil covered with plants together with surface water on a building plot, as well as 50% of the total surface of terraces and flat roofs, landscaped as permanent lawns or flower beds on a soil ensuring the natural vegetation, with an area not smaller than 10 m2.

**Impermeable surface** – surface that is not capable of filtering water.

**Climate risk** – the risk, the scale of the effects and the probability of their occurrence, resulting from the intensity, scale and speed of climate change and extreme weather events related to it, which may have negative impact on people, built-up areas, including technical infrastructure and the natural environment, including the green and blue infrastructure.

**Ecosystems services** – benefits that the natural environment brings to humans and the economy, such as conditions for good quality food production, supply of drinking water and wood, climate regulation and protection from natural threats, soil erosion control and space for leisure activities.

**Climate threat** – includes thermal, hydrological threats as well as a threat of drought and strong winds. The degree of thermal threat to the city results from the assessment including average total solar radiation, albedo of the active surface, land cover and average temperature of the active surface whereas the degree of hydrological threat results from the assessment of the scale of local flooding after heavy rains and submersion as a result of flood. The degree of drought threat is a resultant of the thermal threat and is expressed by the length of the period (days) without precipitation and with high temperature. The degree of threat of strong wind is a combined result of its strength and duration.

[29] A. Arcipowska, A. Kassenberg, Małe ABC... ochrony klimatu, Institute for Sustainable Development, Warsaw 2007.

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