

**Poland's
First Biennial Transparency
Report (BTR1)
for the Conference
of the Parties
to the United Nations
Framework Convention
on Climate Change**

Warszawa 2024

**Poland's First Biennial Transparency Report
under the Paris Agreement
for the Conference of the Parties
to the United Nations Framework Convention on Climate Change (UNFCCC)**



**National Centre for
Emissions Management**
Institute of Environmental Protection
National Research Institute

Published by:

The National Centre for Emission Management (KOBiZE)
at the Institute of Environmental Protection – National Research Institute (IEP-NRI/ IOŚ-PIB)

Authors and editors:

Zbyszko Pisarski, Anna Serzysko, Izabela Zborowska, Joanna Żabicka

Co-authors and contributors:

- Chapter II. Katarzyna Bebkiewicz, Zdzisław Chłopek, Paulina Grzelak, Iwona Kargulewicz,
Chapter III.6. Anna Olecka, Anna Paczosa, Janusz Rutkowski, Jacek Skośkiewicz, Mariusz Walęzak,
Sylvia Waśniewska, Dagna Zakrzewska, Marcin Żaczek
Chapter III. Maciej Cygler, Grzegorz Czekaj, Piotr Dombrowicki, Paulina Grzelak,
Katarzyna Jabłońska, Michał Lewarski, Agnieszka Patoka-Janowska, Zbyszko Pisarski,
Anna Romańczak, Monika Sekuła, Anna Serzysko, Damian Zasina, Izabela Zborowska,
Joanna Żabicka, Przemysław Żydak;
Karol Szymankiewicz (cartographic illustrations)
Chapter IV. Anna Romańczak, Małgorzata Hajto, Ewelina Siwiec, Krzysztof Skotak
Chapter V. Adam Guibourgé-Czetwertyński, Joanna Żabicka
Cover photo Piotr Kardaś

Supervision and correction:

Anna Paczosa, Monika Sekuła, Robert Jeszke

Materials and collaboration:

- Ministry of Climate and Environment
- Ministry of Development Funds and Regional Policy
- Ministry of Agriculture and Rural Development
- Ministry of Infrastructure
- Ministry of Foreign Affairs
- Ministry of Education
- Ministry of State Assets
- Ministry of Culture and National Heritage
- Ministry of the Interior and Administration
- Minister for Senior Citizens' Policy
- Chancellery of the Prime Minister (Civil Society Department)
- Government Centre for Security
- State Water Holding 'Polish Waters'
- General Directorate for Environmental Protection
- Statistics Poland
- General Directorate of the State Forests
- National Institute of Public Health – National Institute of Hygiene – National Research Institute
- National Fund for Environmental Protection and Water Management



Funded by
**NATIONAL FUND
FOR ENVIRONMENTAL PROTECTION
AND WATER MANAGEMENT**

Contents

EXECUTIVE SUMMARY	7
I. INTRODUCTION	9
II. NATIONAL INVENTORY REPORT OF ANTHROPOGENIC EMISSIONS BY SOURCES AND REMOVALS BY SINKS OF GREENHOUSE GASES.....	11
III. INFORMATION NECESSARY TO TRACK PROGRESS MADE IN IMPLEMENTING AND ACHIEVING NATIONALLY DETERMINED CONTRIBUTIONS UNDER ARTICLE 4 OF THE PARIS AGREEMENT	13
1. National circumstances and institutional arrangements.....	13
1.1. Government structure	15
1.2. Population profile	16
1.3. Geographical profile	16
1.4. Economic profile	18
1.5. Climate profile	21
1.6. Sector details	24
1.6.1. Energy.....	25
1.6.2. Transport.....	29
1.6.3. Industry	32
1.6.4. Buildings and residential sector	34
1.6.5. Agriculture.....	38
1.6.6. Forests.....	41
1.6.7. Waste	42
1.7. Institutional arrangements	45
1.7.1. Institutional arrangements for tracking progress	45
1.7.2. Institutional arrangements for implementation of the NDC.....	49
2. Description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates	53
3. Information necessary to track progress made in implementing and achieving its nationally determined contribution under Article 4 of the Paris Agreement	59
3.1. Indicators, definitions, methodologies and progress	59
3.1.1. Indicators, including definitions	59
3.1.2. Methodologies and accounting approach.....	59
3.1.3. Structured summary – status of progress	60
4. Mitigation policies and measures, actions and plans, including those with mitigation co-benefits resulting from adaptation actions and economic diversification plans, related to implementing and achieving a nationally determined contribution under Article 4 of the Paris Agreement	61
4.1. Introduction on policies and measures as well as actions related to the reduction of GHG emissions	61
4.2. Sector-specific policies and measures	62
4.2.1. Cross-sectoral	62
4.2.2. Energy – energy supply and consumption	70
4.2.3. Transport	90
4.2.4. Industrial processes (IPPU)	113
4.2.5. Agriculture.....	116
4.2.6. LULUCF	127
4.2.7. Waste management	131

4.3. Other information on policies and measures	136
4.3.1. Withdrawn policies and measures	136
4.3.2. Policies and measures affecting GHG emissions from international transport	136
4.3.3. Information on the impact of policies and measures on longer-term trends in GHG emissions and removals.....	136
4.3.4. Information on the assessment of the economic and social impacts of response measures.....	138
5. Summary of GHG emissions and removals	141
6. Projections of GHG emissions and removals.....	147
6.1. Introduction and the main socio-economic assumptions for the projections	147
6.2. Projections of GHG emissions and removals in the WEM scenario.....	150
6.2.1. Assumptions for the WEM scenario	150
6.2.2. Projection results in the WEM scenario	154
6.3. Projections of GHG emissions and removals in the WAM scenario	160
6.3.1. Assumptions for the WAM scenario.....	160
6.3.2. Projection results in the WAM scenario.....	164
6.4. Comparison of projected GHG emissions in the WEM and WAM scenarios	170
6.5. Methodology and models used in the development of activity forecasts for the energy sector	173
7. Other information	183
IV. INFORMATION RELATED TO CLIMATE CHANGE IMPACTS AND ADAPTATION UNDER ARTICLE 7 OF THE PARIS AGREEMENT	185
1. National circumstances, institutional arrangements and legal frameworks	185
1.1. National circumstances.....	185
1.1.1. Demographic situation	185
1.1.2. Economic and infrastructure characteristics.....	186
1.2. Institutional arrangements and governance	187
1.3. Legal and policy framework and regulations.....	189
2. Impacts, risks and vulnerability to climate change	191
2.1. Current and projected climate change and associated risks	191
2.1.1. Current climate change in Poland	191
2.1.2. Projected climate change	194
2.1.3. Extreme hazards and their consequences.....	197
2.1.4. Effects of climate change on the Baltic Sea.....	200
2.2. Observed and potential impacts of climate change, including economic, social and environmental vulnerabilities	201
2.2.1. Method of assessing climate vulnerability and risk	201
2.2.2. Sectoral, social and environmental vulnerability to climate change.....	203
3. Priorities and adaptation barriers	211
3.1. National priorities	211
3.2. Adaptation challenges and gaps and barriers to adaptation.....	211
4. Adaptation strategies, policies, plans, goals and actions to integrate adaptation into national policies and strategies.....	213
4.1. Strategic adaptation plan for sectors and areas vulnerable to climate change by 2020 with the prospects until 2030 – National adaptation policy, its objectives and priorities.....	213
4.2. Adaptation policies in sectors and areas vulnerable to climate change.....	214
4.2.1. Urban areas	214
4.2.2. Water management	215
4.2.3. Agriculture.....	217
4.2.4. Biodiversity	218
4.2.5. Forests	219

4.5.6. Baltic coastal zone	220
4.3. Integrating climate change issues with national policies and strategies	221
4.3.1. Development policy framework	221
4.3.2. National Development Concept 2050 (draft)	222
4.3.3. Medium-term national development strategy	223
4.3.4. Development strategies	223
4.4. The ecosystem approach in adaptation policy	225
4.5. Stakeholder involvement in adaptation policy	226
5. Progress on implementation of adaptation	229
5.1. Work on the new National Strategy for Adaptation to Climate Change	229
5.2. Measures related to the implementation of blue-green infrastructure	230
5.3. Sustainable management of rainwater	231
5.4. Agroforestry	231
5.5. Restoration measures for rivers and their valleys	232
5.6. Development of small-scale retention and prevention of water erosion	232
5.7. Forest fire protection	233
5.8. Biodiversity conservation and forest management in the context of climate change	234
5.9. Adapting the coastal zone to climate change	234
5.10. Protection of cultural heritage from climate change	236
6. Monitoring and evaluation of adaptation actions and processes	237
6.1. Monitoring of adaptation actions and processes	237
6.2. Assessing adaptation to climate change	237
7. Information related to averting, minimizing and addressing loss and damage associated with climate change impacts	239
7.1. Observed and potential impacts of climate change	239
7.2. Actions and institutional mechanisms related to averting, minimizing and addressing loss and damage associated with the adverse effects of climate change	242
8. Cooperation, good practices, experience and lessons learned	245
8.1. Measures to share information, good practices, experience and lessons learned	245
8.1.1. Science, planning and policy relevant to adaptation	245
8.1.2. Policy innovation and pilot and demonstration projects	246
8.1.3. Integration of adaptation actions into planning at different levels	247
8.1.4. Cooperation to share information and to strengthen science, institutions and adaptation	247
8.1.5. Area, scale and types of cooperation and good practices	249
8.1.6. Cross-border cooperation with neighbouring countries on adaptation to climate change	250
8.1.7. Improving the sustainability and effectiveness of adaptation actions	251
8.1.8. Actions to support developing countries in the design and implementation of national policies to adapt to climate change	251
8.2. Strengthening research and scientific knowledge on climate change	251
8.2.1. Climate research and systematic observations and early warning systems	251
8.2.2. Climate vulnerability and adaptation studies	254
8.2.3. Monitoring and evaluation studies on the effectiveness of adaptation measures	256
V. INFORMATION ON FINANCIAL, TECHNOLOGY DEVELOPMENT AND TRANSFER AND CAPACITY-BUILDING SUPPORT PROVIDED AND MOBILIZED UNDER ARTICLES 9–11 OF THE PARIS AGREEMENT	257
1. National circumstances and institutional arrangements	257
2. Basic assumptions, definitions and methodologies	258
3. Information on financial support provided and mobilized under Article 9 of the Paris Agreement	259
3.1. Bilateral, regional and other channels	259

3.2. Multilateral channels	259
4. Information on support for technology development and transfer provided under Article 10 of the Paris Agreement.....	259
5. Information on capacity-building support provided under Article 11 of the Paris Agreement	260
INDEX OF ABBREVIATIONS	263
ANNEXES	265
Annex I. Common reporting tables for electronic reporting of information in national inventory reports of anthropogenic emissions by sources and removals of greenhouse gases by sinks (CRFs).....	265
Annex II. Common tabular formats on information necessary to track progress (CTF Tables)	267
Annex III. Common table formats for electronic reporting of information on financial, technology development, transfer and capacity-building support provided and mobilised, as well as support needed and received, under Articles 9-11 of the Paris Agreement (CTF Tables)	269

Executive summary

Poland's BTR1 consists of four key parts, described below.

National GHG inventory

The National GHG Inventory Chapter contains data on Poland's anthropogenic emissions by source and their removal by GHG sinks. The national GHG emissions in 2021 were 399.94 MtCO₂ eq including indirect CO₂ emissions and excluding GHG emissions and removals from the LULUCF sector. This report presents national projections of GHG emissions and removals in two variants: according to the 'with existing measures' scenario (WEM), which includes projected GHG emissions and removals taking into account adopted and already implemented policies and measures to reduce GHG emissions, and according to the 'with additional measures' scenario (WAM), which includes additionally planned actions.

Progress in implementing and achieving nationally determined contributions (NDCs)

The Chapter on progress in the implementation and achievement of the Nationally Determined Contributions (NDCs) describes Poland's actions and progress towards its climate goals. It contains the information necessary to track Poland's progress in implementing and achieving its NDCs in accordance with Article 4 of the Paris Agreement.

Poland, as an EU Member State, co-creates the EU climate policy and is obliged to implement EU legislation in this area. Consequently, the majority of climate protection measures implemented by Poland result from EU regulations. They are aimed at reducing GHG emissions and fulfilling the emission reduction commitments adopted by the EU and Poland, including the EU NDC. This report presents national circumstances, institutional arrangements and cross-sectoral policies and measures, including by sector. Projections of GHG emissions and removals are part of the description of NDCs. The BTR1 is completed by CTF tables.

Climate change impacts and adaptation

The Chapter on climate change impacts and adaptation presents information on Poland's climate change impacts and adaptation under Article 7 of the Paris Agreement.

Clearly progressing across Poland, warming has accelerated in recent years, which means heat waves, severe weather events and droughts, especially during the growing season. The main objective of national adaptation to climate change is to ensure sustainable development and effective functioning of the economy and society under climate change conditions. This report provides information on the impacts of climate change, including damage and loss caused by weather extreme phenomena, as well as national and regional policies and measures to adapt society, the economy and the environment to current and future climate change. Examples of local measures supporting increased resilience of areas or sectors particularly at risk from extreme climate events have been shown.

Financial, technological and capacity-building support

The Chapter on support contains information on financial support, technology development and transfer and capacity building provided by Poland in line with Articles 9-11 of the Paris Agreement. According to the UNFCCC, developed countries (listed in Annex II to the Convention) are obliged to finance measures related to combating climate change and to support developing countries in adapting to these changes. Poland is not covered by Annex II to the Convention and is therefore not subject to the obligations under Articles 4.3, 4.4 and 4.5. However, Poland is covered by Annex I, which obliges it to reduce its GHG emissions. Poland implements aid programmes on a voluntary basis only, contributing to the provisions of Article 9.2 of the Paris Agreement. Financial support is provided both through bilateral, regional and other channels, as well as through multilateral channels. Detailed information on Poland's financial support in 2021 and 2022 can be found in Table 1 and Table 2 of Annex III.

I. Introduction

Climate policy in recent decades has become an extremely important issue that determines measures in all economic, social and health areas. For many years, countries around the world have made commitments to reduce greenhouse gas emissions. The last such agreement took place in 2015 in Paris.

As a signatory to the Paris Agreement¹, Poland has committed to regularly report on its efforts to reduce GHG emissions and adapt to climate change. The first Biennial Transparency Report (BTR1) to the United Nations Framework Convention on Climate Change (UNFCCC), submitted by Poland, is a key element of the implementation of the Enhanced Transparency Framework (ETF), which aims to ensure transparency and accountability in the achievement of national climate targets.

The BTR1 is a government document prepared on behalf of the Republic of Poland. It contains detailed information on the National Inventory Report (NIR) of GHG emissions, progress in the implementation of Nationally Determined Contributions (NDCs), policies and measures (PaMs) taken to reduce emissions, as well as the impacts of climate change and the adaptation measures implemented. In addition, the BTR1 includes data on the financial support Poland has provided in the context of climate measures. The report implements the requirements of Decision 5/CMA.3 on Guidance operationalizing the modalities, procedures and guidelines for the enhanced transparency framework referred to in Article 13 of the Paris Agreement in accordance with the ETF *modalities, procedures and guidelines* (MPGs) contained in the Annex to Decision 18/CMA.1.

Poland's first BTR presents the data covered by the 2021—2022 reporting period, sometimes also presented against the background of historical data going back decades and aims not only to present the current status of the national climate targets, but also to identify areas requiring further measures and technological and financial support. This document is an essential contribution to assessing Poland's progress in the context of global climate protection efforts. The Polish BTR1 has been developed through the cooperation of a number of institutions and a wide range of experts involved, and is aimed not only at fulfilling international obligations, but also at promoting commitment to climate protection.

¹ Poland has joined the Paris Agreement as a member of the European Union and is therefore participating in the EU's collective efforts to achieve its declared GHG emission reductions and is not submitting an individual NDC to the UNFCCC.

II. National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases

'A national inventory report (NIR) of anthropogenic emissions by sources and removals by sinks of greenhouse gases (GHGs)' and the Common Reporting Format Tables (CRF tables) have been reported by Poland to the UNFCCC Secretariat as separate documents and are available at: <https://unfccc.int/ghg-inventories-annex-i-parties/2023>.

III. Information necessary to track progress made in implementing and achieving nationally determined contributions under Article 4 of the Paris Agreement

1. National circumstances and institutional arrangements

National circumstances are natural (geographical), historical, economic and social. The complexity of these circumstances and their interactions shape the country's situation, directly and indirectly influencing the volume of national GHG emissions.

As regards the choice of the base year for the assessment of its obligations under the Climate Convention, Poland adopted 1988, instead of 1990, as reflected in paragraph 5 of Decision 9/CP.2. The year 1988 instead of 1990 was adopted for Poland because 1990 was the first year in Poland after the fundamental political and economic changes, when GHG emissions did not correspond to their normal level, and therefore this year as the base year was not authoritative.

Natural circumstances are related to Poland's location on the European Lowlands, in the transition zone between the Atlantic and continental climate. A consequence of such a geographical location is the variability of weather conditions, which results e.g., in the fact that the heating season, indispensable for proper functioning of society in most regions of the country, lasts approximately 7 months (from October to the end of April), often extending into September and May. In addition, there is a high variability of weather conditions from one year to the next, with the result that, for example, cold, frost and snow occur incidentally or for long periods, not exactly at the same time from one year to the next. However, the need to provide heating, despite these periodic fluctuations, requires heating systems to be on standby, even though they are not constantly in full use.

Historical conditions shaped the country's society and economy for many decades of the 20th century, as they resulted in the total ruin of the country and the destruction of the Polish nation through the war and occupation in 1939—1945, when Poland fell victim to the aggression of foreign powers. In the post-war period, on the other hand, the country found itself in a zone of limited development, resulting from the international balance of political power, which determined the economic underdevelopment lasting until 1989. These conditions meant that the country's potential was not properly exploited and the standard of living of the inhabitants was significantly different from that of Western European countries. The socio-economic transformation, which began in the 1990s, brought temporary perturbations and then accelerated the country's development, consolidated by Poland's accession to the European Union in 2004. Over the last 30 years, and especially in the 20 years of Community membership, Poland has been dynamically developing its economy and trade, catching up on many years of underdevelopment. It is therefore in a peculiar situation compared to other European

countries, belonging to the group of least prosperous societies in the EU-27, as evidenced by the level of national GDP per capita, which, although gradually increasing, was 80% of the EU average in 2022.

Poland is actively participating in the efforts of the international community to combat climate change. During the first commitment period, under the Kyoto Protocol, 2008–2012 it undertook to reduce GHG emissions by 6% compared to its emissions in the base year 1988, achieving emission reductions that far exceeded this target, amounting to approx. 30%. In subsequent years, Poland continued to reduce its GHG emissions. Compared to 1988, national emissions for 2022 decreased by 34.3% [NIR, 2024]. Decoupling of emissions with GDP growth shows that Poland's economy is being run in a sustainable manner.

Poland is implementing the assumptions of the EU climate policy and fulfilling its individual commitments arising from it. As part of the European Union's collective reduction effort for the period 2013–2020, due to the dynamics of its economic development, Poland was set a limit of +14% in relation to 2005 emissions, and this was achieved. The national target for 2030 was set at -17.7%, also in relation to 2005, resulting in a 31.7% change in Poland's reduction effort between 2021 and 2030.

At the same time, as an EU MS, Poland participates in the *European Union Emissions Trading System (EU ETS)*, which covers emissions mainly from the energy sector, but also from the industrial sector and aviation. Emissions reductions and accounting under the EU ETS take place at enterprise level, which means that they are individually responsible for balancing their emissions with a corresponding number of allowances, which they can also trade on the allowance market. In 2022, 565 installations from Poland participated in the EU ETS.

The most important socio-economic determinants relevant to the GHG emissions include:

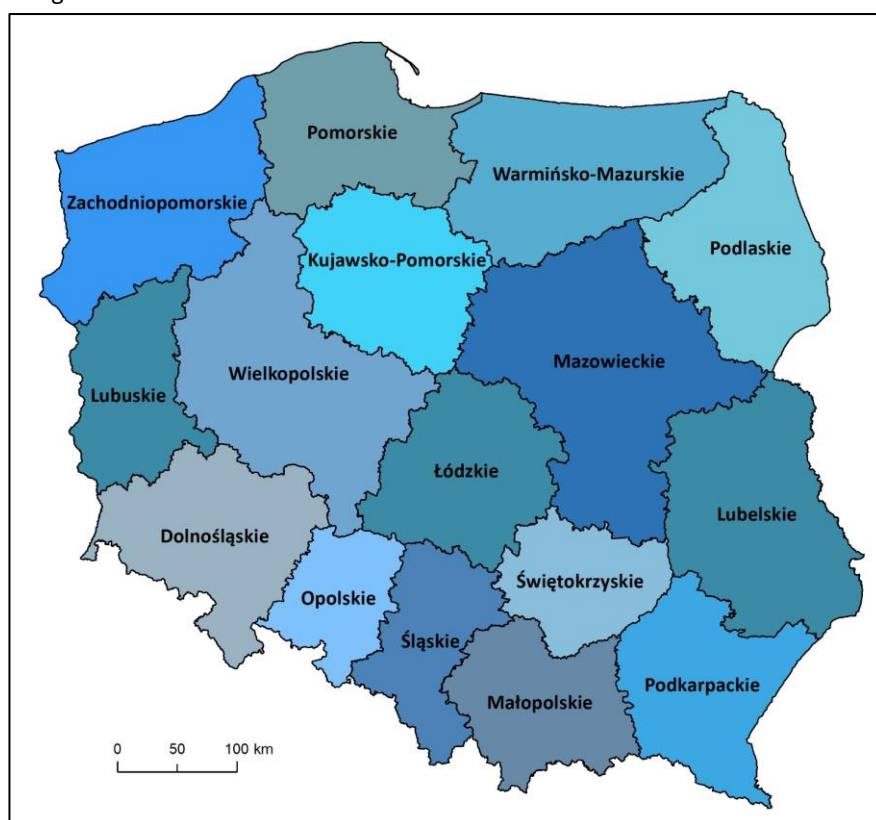
- the peculiarities of the structure of energy acquisition and production (the so-called energy mix), most of which comes from fossil fuels such as hard coal and lignite;
- the maintenance and development of industrial production, some of which is still relatively energy- and carbon-intensive;
- the growing share of emissions from transport, the dynamic quantitative development of which is facing barriers to reducing sectoral emissions;
- the development of subsistence agriculture, which is characterised by low GHG emission reduction potential;
- forest areas whose carbon removal capacity is declining;
- the inefficient housing stock of a major (and poorer) part of the population, which, without adequate modernisation, requires significant thermal energy resources, most often from sources fired by high-carbon fossil fuels;
- changes in the age and occupational structure of the population, manifested by an increase in the size of the economically inactive part of the population, with a decreasing share of the working population;
- the increase in GDP per capita, which is contributing to a gradual growth in the affluence of society and the emergence of Western patterns of consumption; at the same time, the level of ecological awareness among citizens is increasing, as a result of which the issue of combating climate change is becoming more frequently present in public debate and is an important issue in the social and economic life of an increasing number of Poles.

1.1. Government structure

The Republic of Poland is a constitutional republic with a parliamentary-cabinet system of government and a classical tripartite division of power into legislative, executive and judicial. Legislative power is exercised by a bicameral parliament, comprising of the Sejm (Chamber of Deputies) and the Senate (Chamber of Senators). The Sejm and the Senate sitting together form the National Assembly.

Executive power is vested in the President and the Council of Ministers. The government performs its tasks with the help of government administrative bodies and units. At the national level, these are ministries, central offices and foreign services, and at the regional (voivodship) level – the voivodes representing the government together with the voivodship offices subordinate to them, as well as field units of governmental joint administration. At the same time, the principle of decentralisation of public authority causes some of the tasks concerning the fulfilment of the needs of resident communities to be shifted to the competences of local government units.

Fig. 1. Poland – administrative division



Source: <https://www.geoportal.gov.pl/dane/panstwowy-rejestr-granic>

The territorial division of the Polish state has three levels. The basic unit of local government (self-government) is the municipality, the higher one is the powiat (district) and the highest one is the voivodship (province). As of 31 December 2022, there were 16 voivodships, 314 powiats, 66 cities with powiat rights and 2,477 municipalities: 302 urban (including 66 municipalities also having the status of a city with powiat rights), 1,513 rural and 662 urban-rural [Small Statistical Yearbook of the Republic of Poland 2023, Statistics Poland 2023].

1.2. Population profile

As of December 2023, Poland had a population of 37,637,000. Population density varies spatially: on average, it is 125 persons per 1 km², in the most urbanised region of the country – the Śląskie Voivodship, it is 350 persons per 1 km², and in the least populated voivodships: Warmińsko-Mazurskie and Podlaskie – 56 persons per 1 km². The number of urban inhabitants and the percentage of urban population are slightly decreasing, amounting to approximately 60%. In recent years, the number of Poles in working age (18–59 years for women, 18–64 years for men) has decreased, while the proportion of people in post-working age is clearly increasing in the population. The total population of the country is projected to decrease to about 30.9 million in 2060 [Population projection for 2023–2060, Statistics Poland 2023].

Table 1. Age structure of the population 1988–2022 [thousands]

Population	1988	1990	2000	2005	2010	2015	2020	2021	2022
pre-production age	11,281*	11,286	9,333	7,864	7,243	6,902	6,998	6,993	6,951
production age	21,875*	21,898	23,261	24,405	24,831	24,002	22,631	22,385	22,169
post-production age	4,626*	4,889	5,660	5,888	6,456	7,533	8,460	8,530	8,646
Total	37,779	38,073	38,254	38,157	38,530	38,437	38,089	37,308	37,766

*data for 1987, Statistics Poland, 'Small Statistical Yearbook of the Republic of Poland 1989'

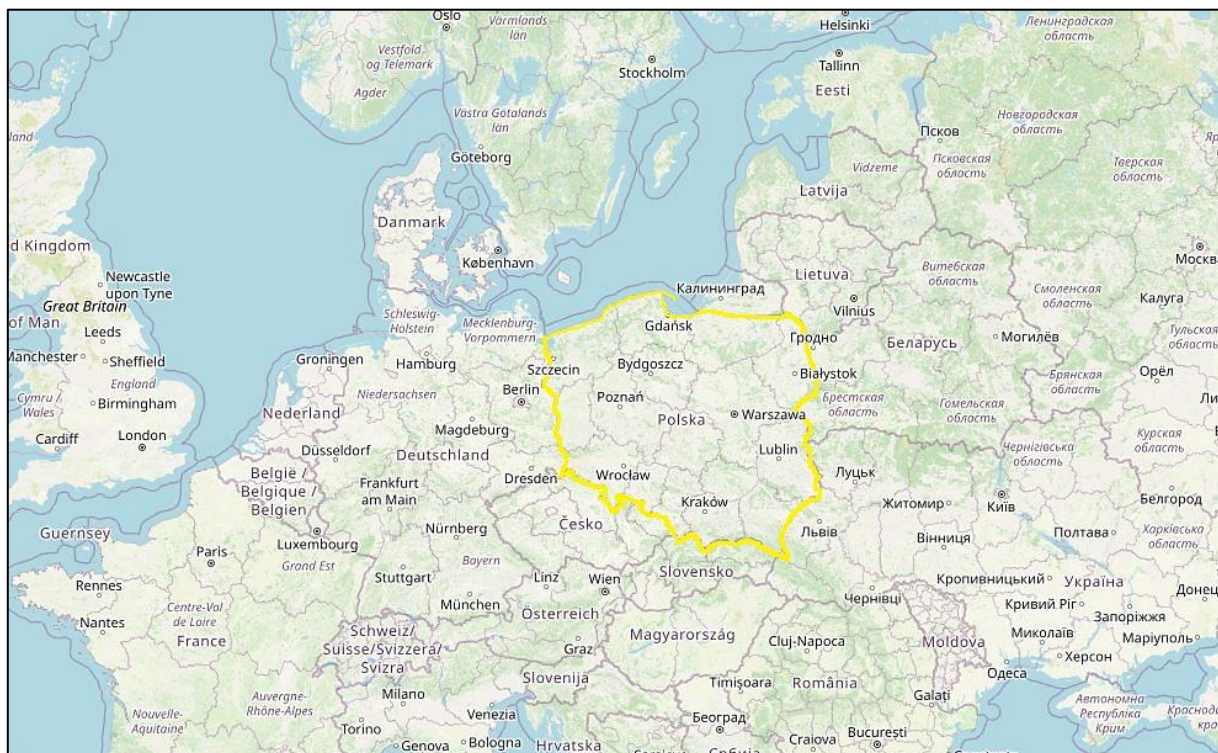
Source: study by KOBIZE, IEP-NRI, according to Statistics Poland 2016–2023, 'Demographic situation in Poland up to 2022'

1.3. Geographical profile

Poland is located at the meeting point of Western and Eastern Europe, in the Central European Lowlands, between the southern coast of the Baltic Sea and the Sudetes and the Carpathian mountains. Such a geographical location makes the country characterised by great climatic, landscape and natural diversity, the specific feature of which is the transition between conditions shaped by Atlantic influences from the west and continentalism influencing from eastern directions, as there are no meridional physical-geographical barriers in the vast areas of the Central European lowlands. In the north of Poland, moreover, the environment shows distinctly coastal, Baltic features, and in the south, within the mountain ranges and uplands, mountain and sub-mountain features. The territory of Poland covers an area of 322,714 km² [Environmental Protection 2023, Statistics Poland].

The diversity of Poland's landscape and ecosystems is due to the band-shaped layout of the geographical landscapes, which extend latitudinally. The predominant landscape is lowland, which, together with the lake district landscape and the landscape of the Baltic coast, constitutes the majority of the country's area. In the south, there are uplands and mountain ranges, including high mountains (up to 2,499 m). Areas elevated above 500 m above sea level cover only 3% of the country. Each geographical region is characterised by the occurrence of peculiar ecosystems which, together with the plant and animal species living there, make up the natural wealth of Poland. Its specificity is particularly shaped by the geographical location in the transitional climate zone with the influence of oceanic air masses from the west and continental air masses from the east, the varied relief and hydrographic system and the variability of the soil substrate.

Fig. 2. Geographical location of Poland



Source: <https://www.openstreetmap.org>

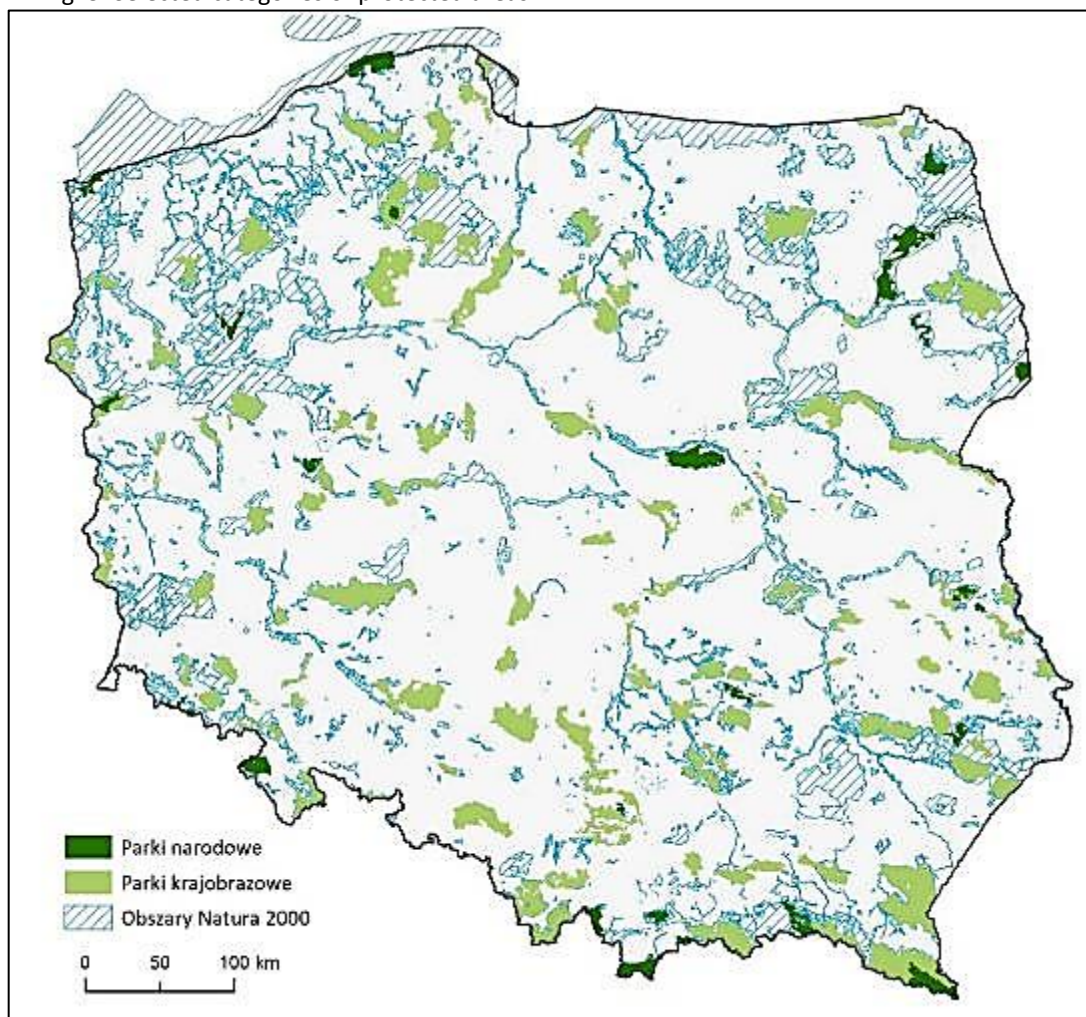
The most valuable ecosystems and habitats of natural and seminatural character are extensive wetlands, including peat bogs, extensive meadows and pastures found in river valleys, mountain and xerothermic grasslands, as well as dense forest complexes. They are sanctuaries for plants and animals, including many endemic species. Strictly protected in Poland are 415 plant species, 232 fungi species and 589 animal species, including 50 – mammals and 427 – birds.

Natural assets are subject to state legal protection, which includes various categories of protected areas. In 2022 these were: 23 national parks, including 10 recognised as World Biosphere Reserves, 1,512 nature reserves, 126 landscape parks, 388 protected landscape areas, 182 documentation sites, 8,329 ecological uses and 324 nature and landscape complexes. Many of these areas are part of the European ecological network Natura 2000, which covers about 20% of the country's land area [Small Statistical Yearbook of the Republic of Poland 2023, Environmental Protection 2023, Statistics Poland].

Land use is characterised by a predominance of agricultural land (about 60% of the country's area) and forests (about 30%). Due to the development of cities and settlements, industrial and service and communication infrastructure, the area of built-up and urbanised land is steadily increasing.

Of the natural resources, energy minerals such as hard coal and lignite and small amounts of crude oil and natural gas are exploited. Of importance is the extraction of metal ores, especially copper, zinc and lead, as well as other minerals, including sulphur, rock salt, rock raw materials, especially limestone and marl, and aggregates, mainly sands and gravels. Thermal and therapeutic waters are also exploited in the country.

Fig. 3. Selected categories of protected areas



Source: <https://geoserwis.gdos.gov.pl/mapy/>

The average water resources in Poland amount to about 60 billion m³, while in dry seasons the level may fall even below 40 billion m³. The volume of these resources per capita is one of the lowest in Europe, amounting to approximately 1.5 thousand m³ yearly [Environmental Protection 2023, Statistics Poland]. The situation is exacerbated by seasonal variability and significant spatial variation in water resources, which, together with the occurrence of extreme weather events, causes droughts and sometimes violent and dangerous floods.

Between 2000 and 2022, water abstraction (excluding irrigation in agriculture and forestry) for the national economy and population decreased by 14%, from 10.9 km³ in 2000 to 9.4 km³ in 2022. The distribution of water abstraction volumes by economic sector has not changed significantly over the past 20 years. The proportions of water use were as follows: 69% water for industry, 22% for municipal economy, 9% for filling and replenishing fishponds [Environmental Protection 2023, Statistics Poland].

1.4. Economic profile

Poland is consistently building its economy, based on its own and imported resources and on effective cooperation with its neighbours and partners from around the world, especially from the European Union. Currently, the Polish economy is the sixth largest in the EU27. The political and socio-economic changes initiated in 1989 enabled the country to leave the inefficient centrally controlled economy

and move towards a market economy, hence Poland was among the countries implementing the economy in transition. Due to the fact that the process of arduous transformation, paid for with difficult challenges for the whole society, lasts a relatively short period of time, it should be noted that despite the achievements transforming the country into a modern state and the acceleration of development, especially since joining the European Union in 2004, the economic level of Poland still places it among the less prosperous members of the EU27.

Table 2. The volume of gross domestic product per capita in Poland (GDP per capita) with comparison to the average level of the Purchasing Power Standard (PPS) in the European Union, 2012—2022

GDP per capita	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
EUR (current prices)	10,190	10,260	10,750	11,390	11,270	12,360	13,280	14,190	14,310	15,770	17,520
PPS [EU27=100]	67	67	67	69	69	69	71	73	76	77	80

Source: Eurostat

The country's economic situation is shaped by factors such as a young and well-educated workforce, a large internal market in the fifth most populous EU country, international legal and business standards implemented in the country, and macroeconomic stability. Poland's strength is its central location in Central and Eastern Europe, which is conducive to economic cooperation and trade, based on an extensive and upgraded transport and logistics infrastructure. The labour market is characterised by a relatively low unemployment rate, which fluctuates around 5—6% (2019—2022).

Until the COVID-19 pandemic, the Polish economy was growing rapidly, expanding its gross domestic product (GDP). Growth stalled and declined in 2020, followed by a rebound and rapid recovery. Further perturbations were triggered by Russian aggression against Ukraine in 2022. During this time, Poland successfully dealt with a large influx of refugees from Ukraine, hosting more than one million people. Despite the challenges posed by the volatile international situation, the share of foreign trade in goods is growing, with Germany, the Czech Republic, France, the UK and Italy being the main partners for export of Polish goods, while imports come primarily from Germany, China, Italy and the USA.

Poland's pre-transformation economy was characterised by a very developed heavy industry and mining infrastructure, the importance of which has decisively declined in the process of economic and social transformation. The modernisation of industry allowed for maintaining part of the production in the country and the creation of new investments, thanks to which manufacturing in Poland has a relatively larger share in the generated added value than on average in the whole European Union. The modernised industry is characterised by a diversified structure with a simultaneous lack of dependence on single sectors prone to disruption. Among the domestic industries, the food and automotive sectors are the most developed. Poland also specialises in production of certain products, such as city buses and furniture, of which it is one of the main producers and exporters in Europe.

The value added generated in Poland, apart from the aforementioned industrial production, as well as construction and – to a small extent – agricultural production, comes mainly from the broadly defined services sector. The entire service activity in Poland generates nearly 2/3 of the gross value added (GVA) in the country. These include financial and insurance activities, trade, transport, information and communication, accommodation and catering, repair of motor vehicles, warehouse management and many others [Gross domestic product and gross value added in regional breakdown in 2021, Statistics Poland 2023].

Table 3. Selected economic indicators and data on Poland's economic development

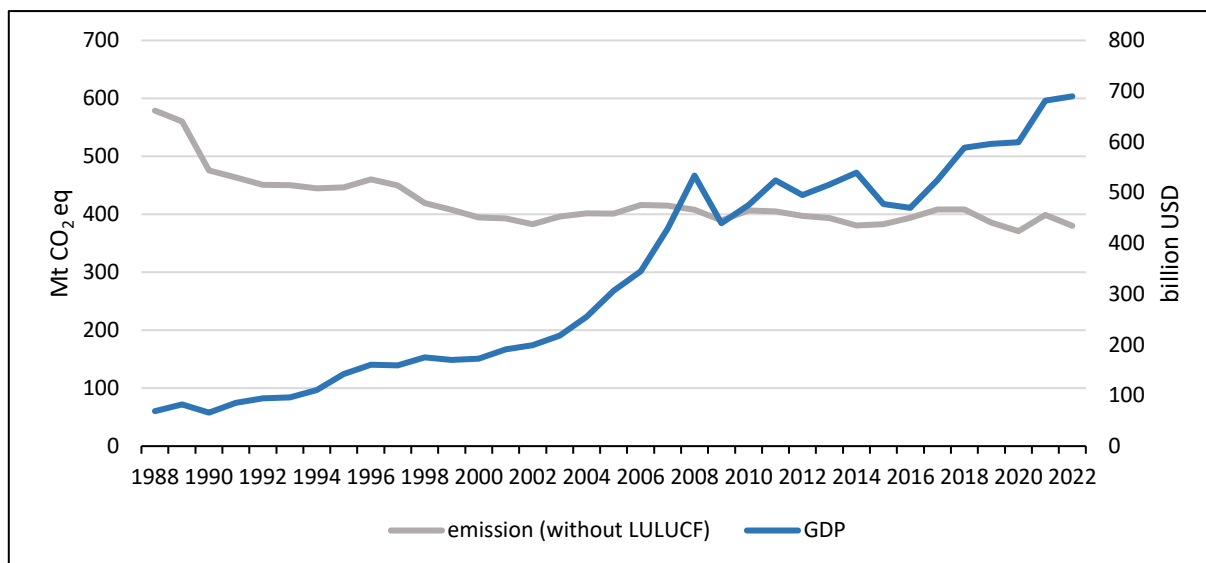
Details	1990	1995	2000	2005	2010	2015	2019	2020	2021	2022
Gross domestic product [1995=100]	.	100.0	129.5	150.2	188.2	219.8	264.6	259.3	277.2	291.9
Consumer price index (CPI) [1995=100]	18.0	100.0	182.0	208.4	238.9	258.4	272.2	281.5	295.9	338.5
Capital expenditure (constant prices) [1995=100]	80.2	100.0	180.4	169.6	262.4	326.9	367.9	349.5	371.5	391.9
Gross value of fixed assets (constant prices) [1995=100]	91.5	100.0	122.0	136.6	161.7	199.8	231.4	239.7	247.8	256.5
Retail trade sales (constant prices) [1995=100]	79.3	100.0	120.3	127.3	155.2	178.7	219.2	211.1	225.7	231.6
Foreign trade turnover – imports [billion USD]	9.52	29.05	48.94	101.54	178.06	197.68	265.76	260.61	343.49	386.97
Foreign trade turnover – exports [billion USD]	14.32	23.00	31.65	89.38	159.76	200.34	267.06	272.66	342.00	365.75
Employed persons per 1,000 population [number of persons]	433	.	405	338	336	386	420	388	396	402
Registered unemployment rate	6.5	.	15.1	17.6	12.4	9.7	5.2	6.3	5.8	5.2

Source: Statistical Yearbook of the Republic of Poland, Statistical Yearbook of Agriculture, Statistical Yearbook of Foreign Trade, Statistics Poland 2010–2023

The national economy is also an area of foreign investment. More than 29,000 enterprises with foreign capital have been registered in Poland, representing around 1% of all companies operating on the domestic market and accounting for nearly 40% of the value added generated in the Polish economy. Germany, the US and France remain the leading direct investors (respectively USD 36.5 billion, USD 26.8 billion and USD 17.3 billion of invested capital and USD 97.6 billion, USD 55.6 billion and USD 62.6 billion of held assets). In 2022, the net inflow of capital from foreign direct investment amounted to PLN 140.3 billion, going mainly to entities engaged in industrial processing, trading and financial and insurance activities [Foreign Direct Investment in Poland 2022, National Bank of Poland (NBP)].

The development of infrastructure has been accelerated thanks to support from EU structural funds, which Poland, as a less prosperous EU Member State, can benefit from. The funds invested have expanded and modernised e.g., the infrastructure for environmental protection, transport and the use of RES, as well as improved the living conditions of the population in urbanised and rural areas in terms of health, culture, education, transport and communication, etc.

Fig. 4. GDP volume against total emissions, 1988—2022



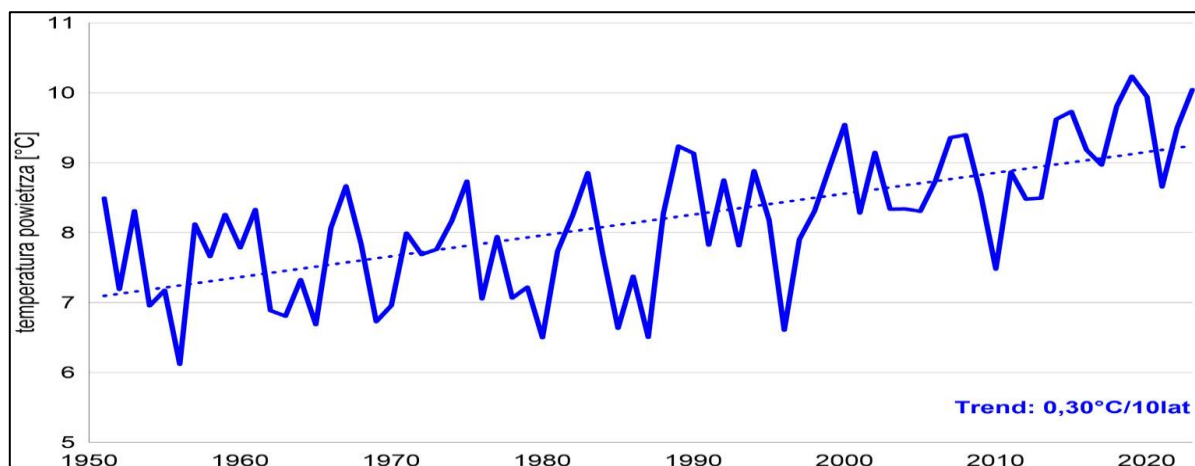
Source: NIR, World Bank

Poland's economy, with increasing GDP while reducing domestic consumption of raw materials, is characterised by an increase in resource productivity, including an increase in energy productivity (*resource decoupling*). A growing economy and declining GHG emissions are evidence of the country's development and its contribution to climate protection efforts.

1.5. Climate profile

Poland lies in the zone of warm temperate transitional climate, in which conditions are shaped by the impact of prevailing oceanic and continental air masses. The parallel layout of geographical areas and the predominant share of lowland areas (the vast Central European Plain) mean that the ranges of influence of air masses are variable and, as a result, the specific features of Poland's climate are its transitivity, as well as its interannual and seasonal variability.

Fig. 5. Variability of mean annual air temperature in Poland in the period 1951—2023

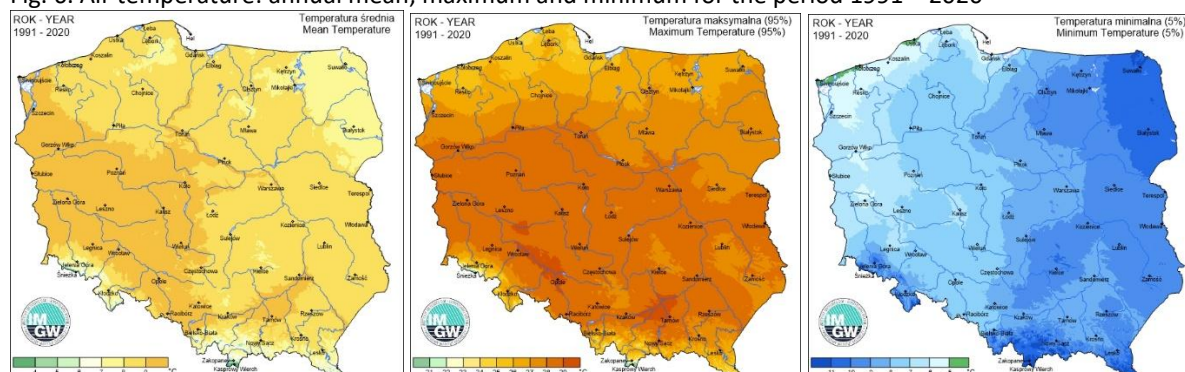


Source: Climate of Poland 2023, IMGW-PIB, 2024

Polish climate shows regional variations, shifting from the most continental in the north-east to the mildest in the west of the country. The regional variation is further shaped by the relief of the terrain, especially in the upland areas and the mountains, where there is a harsher sub-mountain and mountain climate, while on the sea coast the climate features are mitigated by the influence of the

Baltic Sea. The warmest areas are the south-western and southern areas, especially the Silesian Lowlands, the Lubusz Land or the Sub-Carpathian Basins. In contrast, the coolest region is north-eastern Poland, especially Suwałki Region (*Sudovia*).

Fig. 6. Air temperature: annual mean, maximum and minimum for the period 1991—2020



Source: Climate maps of Poland, IMGW-PIB, 2024; <https://klimat.imgw.pl/pl/climate-maps>

The range of mean annual air temperature, except in mountainous areas, varies from around 8°C in north-eastern Poland to around 11°C in the south-west of the country. The range of extreme measured values in the long-term period 1951—2022 is between the lowest observed temperature of -39.0°C (in 1963) and a maximum of 39.5°C (in 1994), while the highest recorded amplitude at a single measuring station was 70.9°C. The absolute extremes of temperature observed in 2022 were as follows: an absolute minimum of -21.5°C and an absolute maximum of 38.3°C [Small Statistical Yearbook of the Republic of Poland 2024, Statistics Poland 2023/2024].

Table 4. Selected air temperature and precipitation data

Meteorological station	Location	2010	2015	2020	2021	2022	2010	2015	2020	2021	2022
	m a.s.l.	average annual temperature [°C]					annual precipitation [mm]				
Warszawa	106	8.0	10.3	10.5	8.9	9.9	798	404	646	676	460
Białystok	148	6.8	8.6	9.2	7.5	8.2	851	526	640	684	603
Jelenia Góra	342	6.4	9.1	8.9	7.9	8.8	984	473	754	683	567
Koszalin	33	7.2	9.5	10.1	9.1	9.7	802	684	631	642	562
Kraków	237	7.5	10.0	10.0	8.9	9.8	1021	551	672	775	593
Lublin	238	7.5	9.4	9.6	8.1	8.9	751	532	698	638	469
Nowy Sącz	292	8.1	9.9	9.9	8.8	9.7	1155	544	710	953	617
Olsztyn	133	6.7	9.0	9.5	8.1	8.9	753	567	668	677	487
Poznań	87	7.7	10.4	10.8	9.5	10.6	715	438	492	527	415
Rzeszów	212	8.1	10.1	10.1	8.8	9.9	966	468	685	828	549
Suwałki	184	6.2	8.2	8.9	7.1	7.8	729	593	612	720	633
Szczecin	1	8.0	10.2	10.7	9.6	10.4	715	438	410	543	445
Terespol	133	7.7	9.5	9.9	8.3	9.0	717	453	591	633	538
Wrocław	69	8.2	11.1	11.0	9.8	10.9	692	388	727	498	507
Zielona Góra	69	7.7	10.4	10.7	9.3	10.6	746	473	548	702	442

Source: study by KOBiZE, IEP-NRI, according to data from the IMGW-PIB and Statistical Yearbook of Agriculture 2023, Statistics Poland 2023

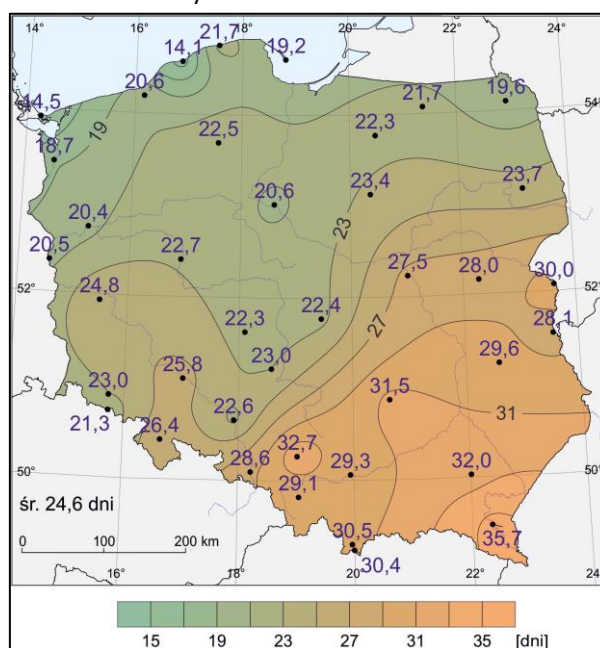
Fig. 7. Distribution of annual precipitation totals from 1991 to 2020



Source: <https://klimat.imgw.pl/pl/climate-maps/#Precipitation>

Precipitation characteristics are marked by strong spatial variability determined mainly by the terrain and atmospheric circulation, i.e. exposure to rain-bearing winds. Average precipitation amounts to almost 600 mm. The annual precipitation in Poland is one of the lowest in northern Europe, matching the minimum values from the south of the continent in some places, which results in a negative water balance during the growing season (predominance of evaporation over precipitation). The highest precipitation occurs in southern Poland, in mountainous and sub-mountainous areas, where within the Carpathian Mountains it exceeds 1,000 mm. The lowest rainfall is recorded in central Poland, in Wielkopolska and the Kuyavia region – less than 500 mm. Intense rainfall occurs from April to September, most in July, and is often associated with the occurrence of thunderstorms. The thunderstorm season in Poland reaches its peak in summer, from June to August.

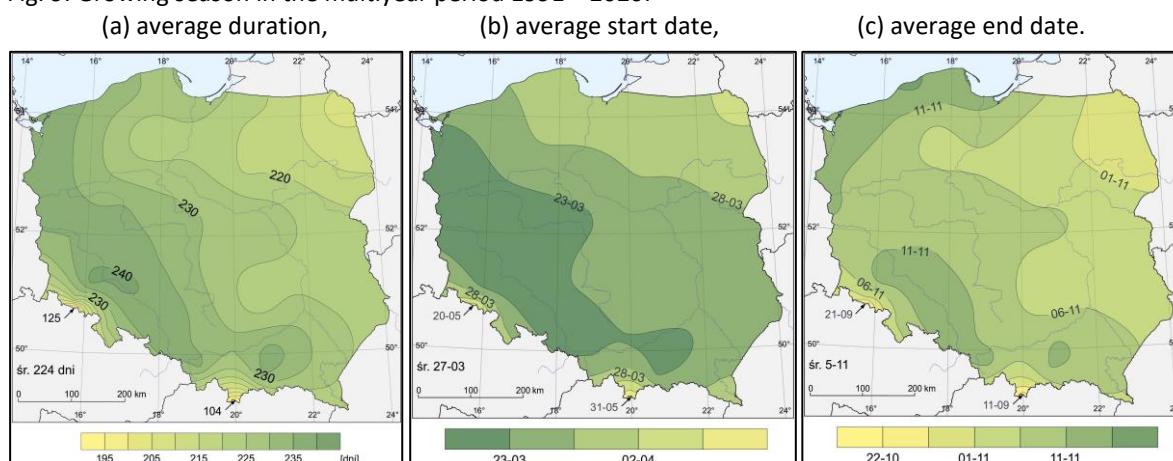
Fig. 8. Average annual number of days with a thunderstorm in Poland during the warm season



Source: *Climate Atlas of Poland (1991–2022)*, 2022. Scientific ed. Tomczyk A.M., Bednorz E.

The length of the growing season is 236 days per year on average (2001—2020 period)², and changes mostly according to the temperature gradient, becoming longer from the north-east to the south-west of Poland. The difference between the station with the longest growing season (Wrocław: 255 days) and the shortest (Suwałki: 207 days) is 48 days in this twenty-year period. Most often, the period begins on 22 March and the latest on 15 April. The last day of the growing season can occur in November. As a consequence of increasing temperatures, the growing season starts earlier, and the date of its end falls later and later as the years go by³.

Fig. 9. Growing season in the multiyear period 1991—2020:



Source: *Climate Atlas of Poland (1991—2022)*, 2022. Scientific ed. Tomczyk A.M., Bednorz E.

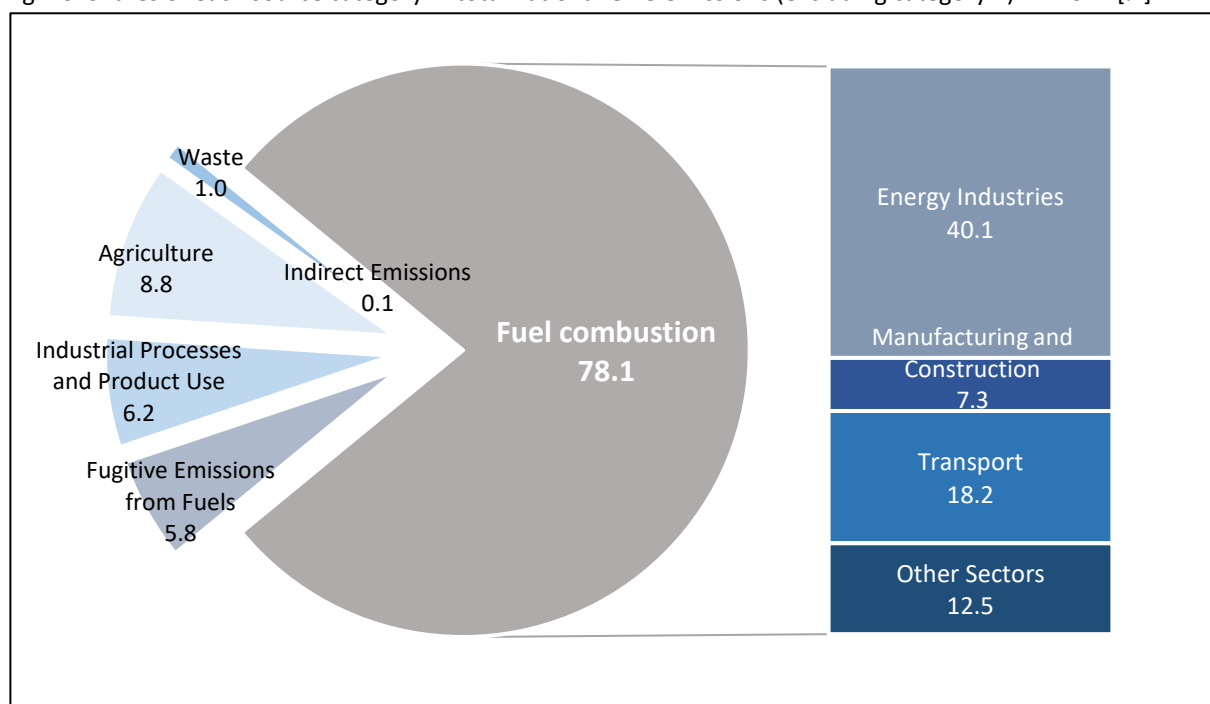
The current intensification of extreme phenomena is noticeably changing the dynamics of climate features in Poland. The unfavourable phenomena are intense heat waves and hot days, increasingly frequent torrential rains and, at the same time, periods without precipitation, which are becoming longer. For Poland, climate change also means increasingly frequent droughts of high intensity and extent, particularly acute during the intensive growing season, and floods, increasingly probable and dangerous.

1.6. Sector details

The country's economic sectors have a diverse impact on GHG emissions. The largest share, 78% of total national emissions in 2022, came from fuel combustion, with three dominant source categories: energy industries (sector 1.A.1), road transport (sector 1.A.3.b) and other sectors (sector 1.A.4).

² Żyłowska K., Kozyra J. 2022. Changes in agroclimatic conditions in Poland. Studies and Reports of the Institute of Soil Science and Plant Cultivation – National Research Institute, Notebook 67(21): 9-23; <https://doi.org/10.26114/sir.iung.2022.67.01>

³ Tomczyk A.M., Szyga-Pluta K. 2010. The growing season in Poland 1971-2010. *Geographical Review*. 2016 (88)/1, p. 75-86.

Fig. 10. Shares of each source category in total national GHG emissions (excluding category 4)⁴ in 2022 [%]

Source: KOBiZE, IEP-NRI, NIR 2024 (Synthesis Report, fig. 3)

1.6.1. Energy

The acquisition of primary energy in Poland largely uses solid fossil fuels, which are hard coal and lignite, and increasingly – renewable energy sources (RES) and biofuels. In 2022, the most important sourced energy carriers were hard coal, whose share was 50.2%, and lignite, giving 17.6% of the volume of sourced energy [Fuel and Energy Economy in 2021 and 2022, Statistics Poland 2023]. So far, Poland does not have nuclear energy sources in the power sector.

Table 5. Primary energy consumption [Mtoe]

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
99.12	97.86	95.69	98.02	93.09	96.08	99.90	98.43	91.60	89.50	84.85	85.97	85.13	86.99	87.02	87.96	92.34
2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
91.90	93.09	89.53	96.56	96.55	92.80	93.40	89.50	90.10	94.80	99.10	104.1	100.2	96.80	104.0	98.60	

Source: Eurostat

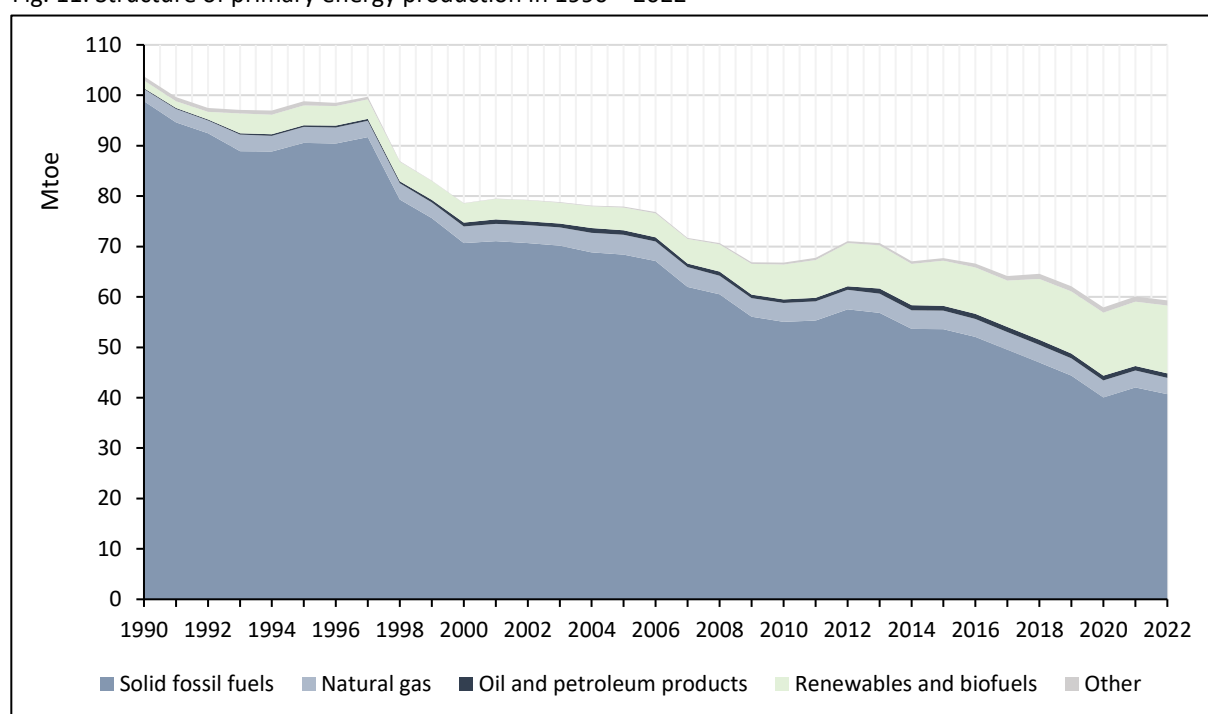
Primary energy consumption in Poland has been changing with the country's transformation. The energy-intensive economy was undergoing economic transition, resulting e.g., in a decrease in the amount of energy consumed, from 99 Mtoe in 1990 to 85 Mtoe in 2000. Consumption then began to increase with the intensification of economic development until it reached a similar level of consumption as at the beginning of the transition. The gradually declining share of solid fossil fuels was accompanied by growing role of less carbon-intensive energy carriers such as oil, natural gas and RES.

The upward trend in primary energy consumption has been particularly evident in recent years, when the economy has entered a period of dynamic growth, following the previous slowdown in 2012–2013. At that time, energy consumption increased from around 90 Mtoe to around 100 Mtoe, while in 2022 it reached 98.5 Mtoe. The growth rate of total primary energy consumption in the economy was lower than the growth rate of the economy (taking the year 2000 as a basis), indicating a relative break

⁴ Category 4. Land Use, Land-Use Change and Forestry (LULUCF) is one of the five main source categories of GHG emissions

in the relationship between GDP growth and energy use [Green Economy Indicators in Poland 2022, Statistics Poland 2022].

Fig. 11. Structure of primary energy production in 1990—2022



Source: study by KOBIZE, IEP-NRI, based on Eurostat data

The structure of primary energy generation in Poland is gradually changing through the decreasing share of hard coal and lignite in favour of RES, which means that solid fossil fuels are systematically giving way to less carbon-intensive energy sources. While in 1990, 95% of primary energy production came from hard coal and lignite, by 2000 the share of both fuels had fallen to 90%, in 2014 – to 80%, in 2020 below 70% and in 2022 it was around 68%. At the same time, the importance of RES and biofuels began to increase from around 5% in 2000, to over 12% in 2014 and to 22.7% in 2022.

A significant proportion of energy comes from imports, primarily in the form of oil imported almost entirely from abroad and natural gas, of which domestic extraction covers about 20% of consumption. In the pre-transition period, domestic coal mining covered energy demand and fed exports. Self-sufficiency ended as the extraction of own coal resources was reduced and more energy resources were imported from abroad. In the 1990s, Poland's minor dependence on imports of energy carriers began to emerge, which then amounted to 11% in 2000, 20% in 2006, 30% in 2015, continuing to grow until 2019, when it reached 45%, after which it began to decline to 43% in 2020 and to around 40% in 2021, while it increased again in 2022, exceeding 46% [Energy 2024, Statistics Poland 2024].

Table 6. Level of Poland's dependence on imports of energy carriers [%]

1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020	2021	2022
0.85	-0.19	10.72	17.75	31.57	29.85	30.76	38.27	43.51	45.24	42.77	40.46	46.03

Source: Eurostat

In 2022, the volume of imports of energy carriers increased by more than 8% compared to the previous year. Almost 42% of fuel imports consisted of crude oil, 20% of natural gas, 18% of hard coal and the remaining 20% were other energy carriers, mainly diesel and liquefied petroleum gas [Fuel and Energy Economy in 2021 and 2022, Statistics Poland 2023].

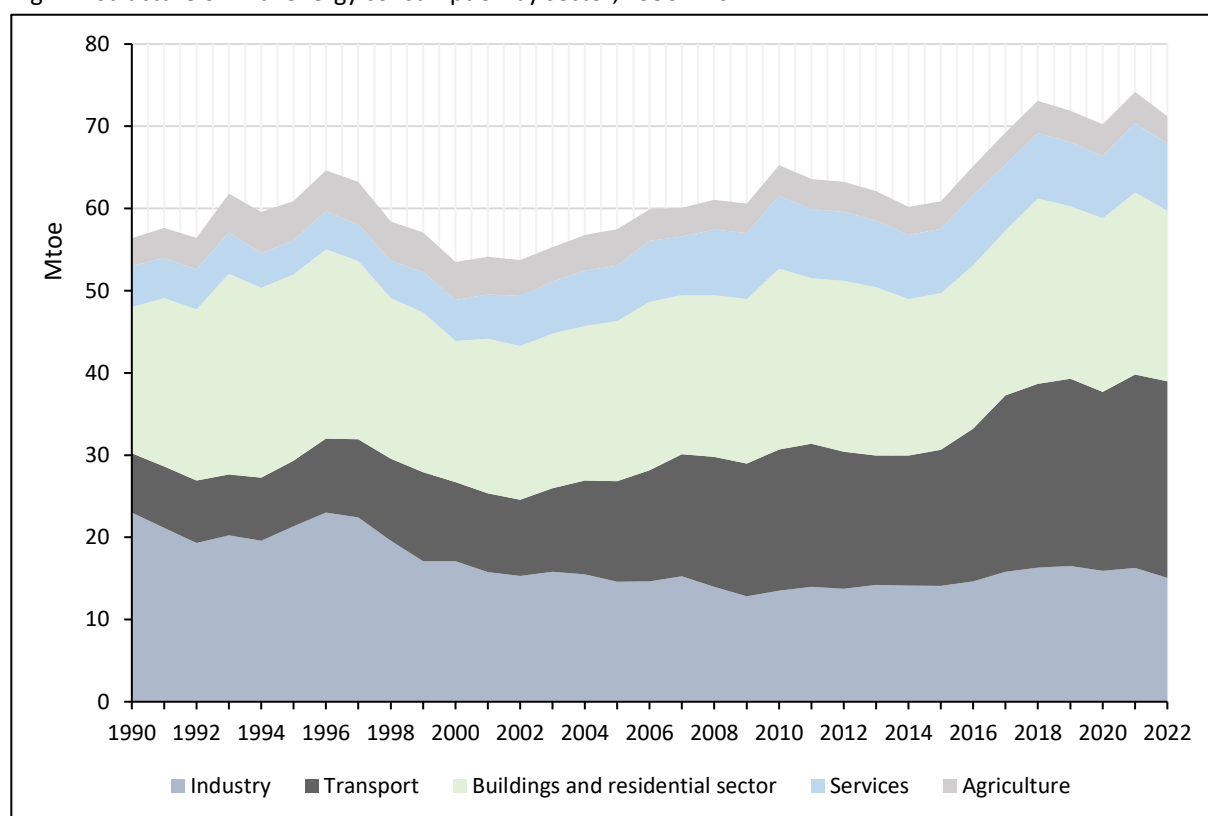
Table 7. Final energy consumption [Mtoe]

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
59.79	60.16	58.97	63.43	61.40	62.83	66.37	65.05	59.86	58.31	55.06	55.46	54.90	56.54	58.09	58.49	61.22
2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
61.62	62.49	61.52	66.28	64.67	64.43	63.25	61.55	62.30	66.60	70.90	74.88	73.73	71.13	75.16	72.43	

Source: Eurostat

Final energy consumption has undergone significant changes in recent decades, due to factors such as economic development, social changes, increased living standards and consumption. In 2022, final energy consumption in Poland was more than 21% higher than in 1990 and, as in the case of primary energy, the largest increase occurred after 2014.

Fig. 12. Structure of final energy consumption by sector, 1990–2022



Source: study by KOBiZE, IEP-NRI, based on Eurostat data

Economic development not only influences the volume of energy consumption, but also changes its sectoral structure. Improvements in energy efficiency and restructuring of the most energy-intensive manufacturing branches have resulted in a decrease in the amount of energy consumed by industry, while there has been an increase in consumption in services and, above all, in transport. Both energy consumption in agriculture and in the municipal economy (residential sector) has remained at roughly similar levels.

Changes in the structure of final energy consumption used by end-users for energy purposes (without further conversion to other energy carriers) indicate an increase in the use of energy in transport, resulting from the dynamic development of transport and services. The transport sector was the largest energy consumer in 2022 with a share of 33.6%, while households consumed 29.2%, industry 21.2%, services 11.5% and agriculture 4.7%. Industry decreased its share in final energy consumption the most, with a decrease of nearly 35% compared to 1990, as a result of restructuring and the introduction of modern and energy-efficient technologies within the sector [Eurostat]. Within manufacturing, the food, paper, chemical and mineral industries consume the most energy, and they

are also among the most energy-intensive manufacturing industries [Energy Efficiency in Poland 2012—2022, Statistics Poland 2024].

Table 8. Energy intensity of GDP (constant prices) [kgoe/thousand euro2015]

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007.	2008
510.62	501.12	464.55	414.23	386.02	353.58	351.60	340.65	337.75	322.81	315.85	313.40	291.45	283.01
2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
263.89	276.21	262.99	249.08	248.73	230.63	223.48	227.70	226.73	223.65	206.55	204.69	203.82	184.13

Source: Eurostat

The country's economy is improving its energy efficiency, which can be demonstrated, for example, by energy intensity and productivity indicators [Green economy indicators in Poland 2022, Statistics Poland 2022]. The relationship between final energy consumption in the economy and the volume of GDP is changing with the energy transition, involving the replacement of coal with other fuels and the development of RES applications. The previously high energy intensity of GDP has declined spectacularly during the transition: its level from 1995 was halved in the period up to 2012 and almost two-thirds by 2022. Energy consumption is therefore characterised by a marked improvement in productivity, which, although not yet reaching the EU27 average, is consistently approaching it, as it is growing slightly faster in Poland than on average across the European Union [Eurostat].

Table 9. Share of RES in energy consumption by sector and in total economy, 2004—2022 [%]

Sectors	2004	2006	2008	2010	2012	2014	2016	2018	2020	2021	2022
Electric power engineering	2.05	2.86	4.25	6.55	10.61	12.36	13.34	13.03	16.24	17.17	21.01
Transport	1.58	1.82	4.14	6.64	6.53	6.32	3.97	5.72	6.58	5.68	5.79
Heating and cooling	10.21	10.17	10.85	11.81	13.50	14.24	14.92	21.47	22.14	21.00	22.73
Total economy	6.88	6.86	7.69	9.28	10.96	11.60	11.40	14.94	16.10	15.61	16.88

Source: Eurostat

In Poland, there is a gradual increase in the share of energy from renewable sources in final energy consumption. In 2022, the share of RES was close to 17% of final energy. On a sectoral basis, renewable energy is gaining increasing importance in the electricity sector, as well as in heating and cooling, exceeding 1/5 of the share in gross final energy consumption in both sectors. Both sectors are therefore marked by a shift away from carbon-intensive fuels towards the use of renewable sources, which is of great importance both for the economy as a whole and for the municipal economy in particular. Transport, on the other hand, is the sector where the importance of RES has been fluctuating around 6% for more than a decade and has not reached higher values so far.

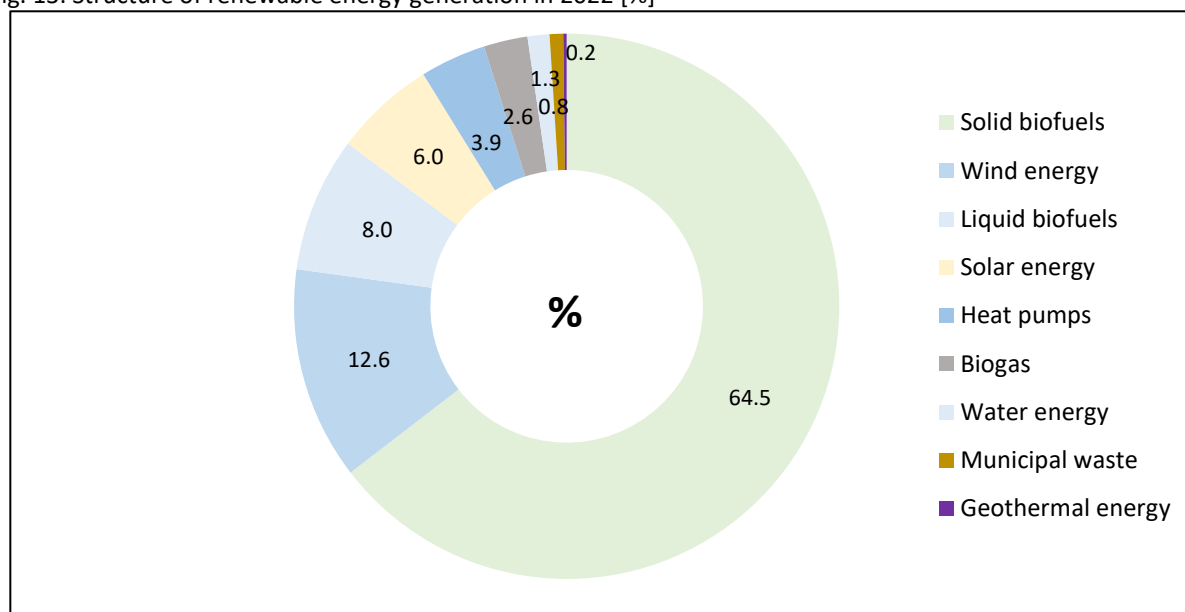
Table 10. Electricity production volumes by RES source category, 2004—2022 [ktoe]

Categories	2004	2006	2008	2010	2012	2014	2016	2018	2020	2021	2022
Water energy	157.9	169.1	177.9	188.7	193.5	197.9	199.3	200.9	199.7	199.9	199.1
Wind energy	10.0	28.0	73.6	146.2	387.8	651.2	1,035.3	1,174.2	1,294.3	1,422.0	1,628.1
Solar energy	0.0	0.0	0.0	0.0	0.1	0.6	10.7	25.8	168.4	338.3	714.5
Solid biofuels	77.1	157.6	289.2	507.8	819.3	787.6	594.4	458.6	596.1	550.2	510.2
Other RES	7.4	13.8	21.9	34.3	48.6	70.2	89.5	104.3	121.7	142.8	145.9
Total RES	252.5	368.4	562.6	877.0	1,449.3	1,707.5	1,929.1	1,963.8	2,380.2	2,653.2	3,197.8

Source: Eurostat

The electricity generation sector is one that is particularly increasing the use of renewable energy sources. The role of RES in the power generation sector is growing, starting from a mere 2% share of electricity production in 2004, through 10% between 2012 and 2014, when electricity production from wind farms began to be of comparable importance to that from solid biofuels, until 2022, when the share of RES reached 21%, boosted in particular by the increase in wind power. Thus, the volume of electricity production from wind farms exceeded half of the total electricity production from RES [Eurostat].

Fig. 13. Structure of renewable energy generation in 2022 [%]



Source: study by KOBiZE, IEP-NRI, according to Statistics Poland, Energy 2024

Domestic renewable energy generation and use has been dominated by solid biofuels for a number of years. However, their share in renewable energy generation is changing with the development of wind and solar installations, as well as heat pumps, number of which is rapidly increasing.

Table 11. Price evolution of electricity (elec.) and gas for households [EUR/1 kWh]

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
elec.	0.138	0.130	0.129	0.138	0.135	0.153	0.144	0.141	0.142	0.135	0.145	0.140	0.138	0.151	0.157	0.160
gas	0.040	0.052	0.046	0.051	0.050	0.058	0.051	0.050	0.050	0.044	0.044	0.045	0.047	0.042	0.047	0.055

Source: Eurostat

As energy prices, including electricity and gas prices, are important for consumers, especially households, state policy takes into account their social importance. Therefore, the price level for individual consumers is regulated by the state.

1.6.2. Transport

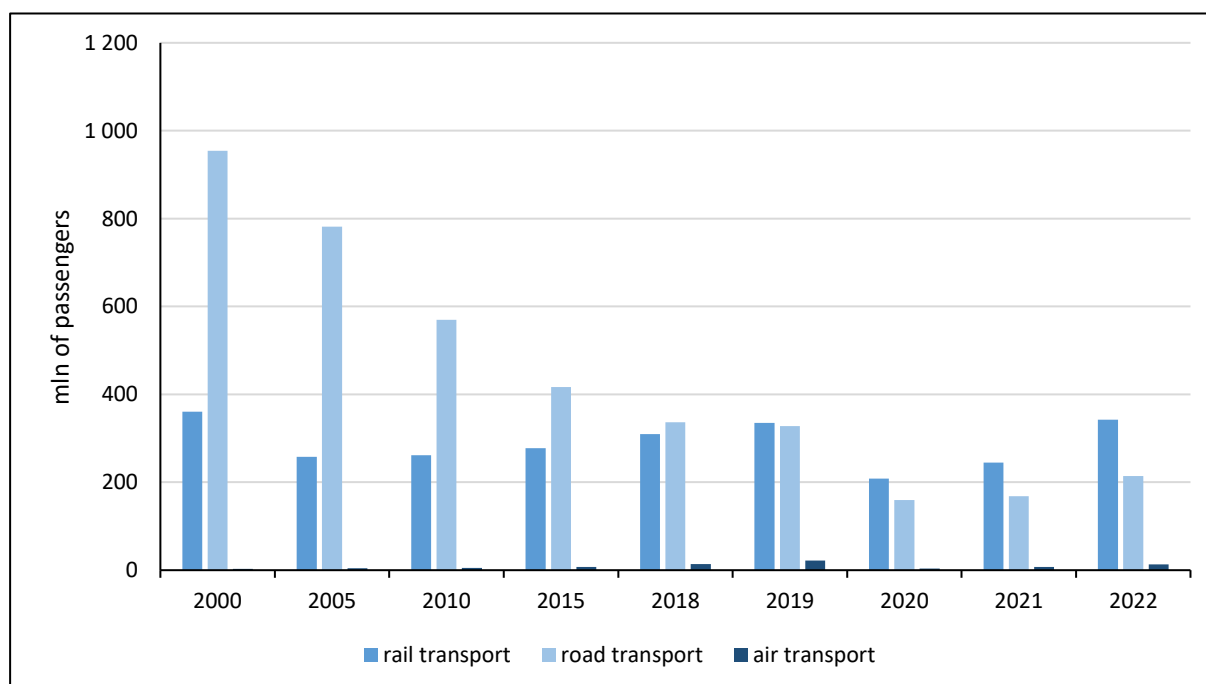
Both passenger and freight transport is the sector that has developed particularly rapidly in Poland over the last 20 years. This has resulted in increased GHG emissions and places the transport sector among the main drivers of emissions growth. The sector's fuel consumption is dominated by road transport, as its share in total freight transport accounted for nearly 87% in 2022. Approximately 2.3 billion tonnes of goods were then transported by all modes of transport, with transport work performed reaching almost 500 billion tonne-kilometres, 1.3% higher than the year before. The data on transport varies depending on the type of transport and includes only Polish carriers, and therefore

does not provide a full picture of the transport situation in Poland [Transport – activity results in 2022, Statistics Poland 2023].

In 2022, the volume of freight transport by road expressed in tonne-kilometres was the highest in Poland in the EU27, accounting for 20.1% of total transport in the Community. In international transport, Poland's share was also the largest, accounting for 1/3 of total transport in the European Union. Similarly high – second – position among EU countries, between Germany and France, was held by Polish rail carriers in terms of the weight of freight transported in both 2019 and 2020 [Transport – activity results in 2022, Statistics Poland 2023].

After the pandemic period, in 2022, Polish passenger transport operators by rail, road, air, inland waterway and sea (excluding urban transport companies) collectively recorded a greater increase in transport than Polish freight operators – the number of passengers handled by them increased by 35% compared to the previous year, amounting to 572 million, while transport work amounted to 63.4 billion passenger-kilometres and was 73% higher than the previous year. The largest increase was in air (by 84.3%), rail (by 39.7%) and road transport (by 27.2%), while inland waterways saw the smallest increase (by 11.6%) [Transport – activity results in 2022, Statistics Poland 2023].

Fig. 14. Transport of passengers by rail, road and air, 2000–2022



Source: study by KOBiZE, IEP-NRI, according to 'Transport – activity results in 2022', Statistics Poland 2023

In contrast, over the last decade or so, the structure of passenger transport has shown a declining role for road transport, while the volume of rail and also air transport has increased. As of 2019, rail started to be the main mode of passenger transport in Poland. However, when the COVID-19 pandemic state occurred in 2020, domestic and international passenger traffic was reduced. Between 2021 and 2022, the upward trend in passenger traffic resumed. Although the rebound was particularly dynamic in the restored air traffic, only rail reached or even exceeded the pre-restriction volume level by 2022.

Table 12. Number of passenger cars* per 1,000 inhabitants, 2002—2022 [pcs]

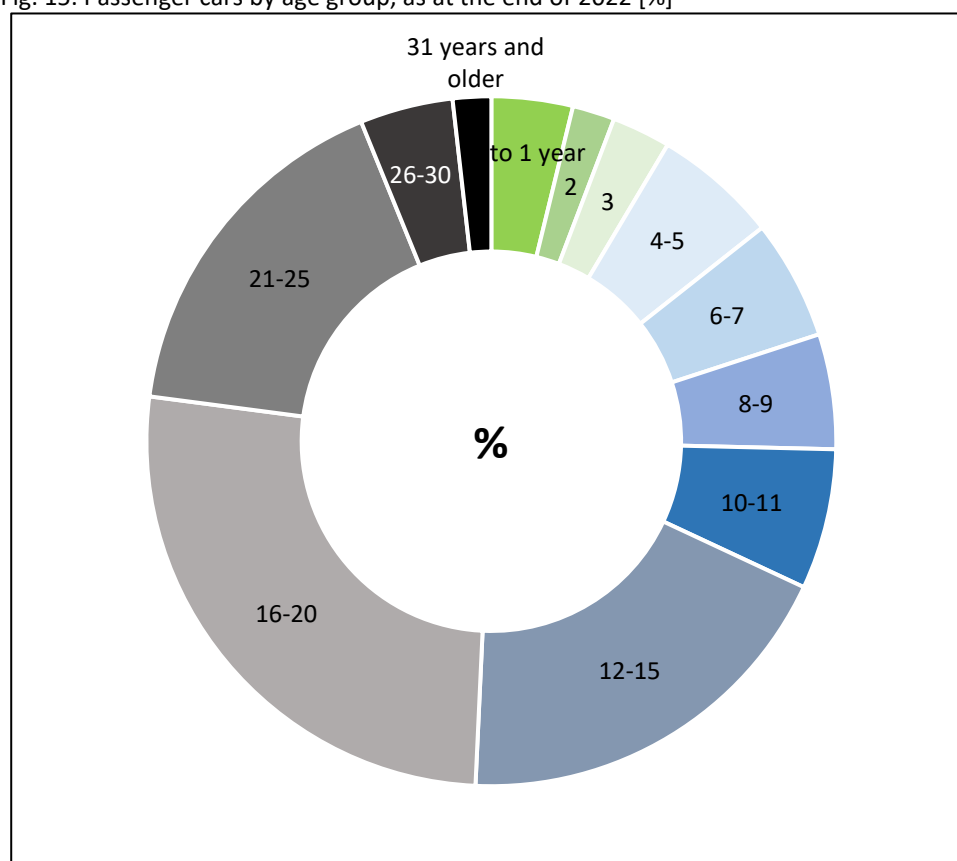
2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
289	294	293	323	351	383	422	432	447	470	486	504	520	539	564	586	610	635	659	682	701

*these figures also include the number of vehicles that are not used but also not de-registered

Source: Statistics Poland 2023

The Central Vehicle Register showed a total number of motor vehicles and tractors registered at the end of 2022 of 34.9 million, of which almost 26.5 million were passenger cars. Since 2021, the number of passenger cars has increased by 2.3% and their number per 1,000 inhabitants has exceeded 700. However, it should be noted that of the approximately 26.5 million passenger cars in Poland, almost 7 million (that is, about ¼) are not used and not de-registered vehicles. The age structure of used passenger cars is characterised by a similar share of new vehicles and old and very old vehicles – 49.27% of passenger cars in Poland are over 15 years old, which translates into the volume of emissions from the sector [KOBIZE own study based on Central Register of Vehicles and Drivers database for 2022]. Although electric cars are on the rise, their number is relatively small: 30,841 fully battery electric vehicles (BEVs) were registered in 2022 [Eurostat].

Fig. 15. Passenger cars by age group, as at the end of 2022 [%]



Source: study by KOBIZE, IEP-NRI, based on Central Register of Vehicles and Drivers database for 2022

Urban transport is operated by public transport companies, which transport passengers by bus, tram and trolleybus fleets. Cities are engaged in promoting public transport and are increasingly using low-emission vehicles. Urban transport carried 3.06 billion passengers in 2022, which was 22.3% more than in 2021. Similarly, the Warsaw metro (the only one in the country) recorded a significant increase in passenger transport, with 41% more passengers than in the previous year, and the number of metro passengers in 2022 reached 165 million.

1.6.3. Industry

Industry is one of the pillars of the Polish economy. Along with the economic changes, there has been a restructuring and modernisation of domestic production and cooperation, which has brought industrial processing to a modern level. This has been helped by investments that have contributed to the construction and expansion of manufacturing units using increasingly advanced technologies. A large part of industry has become less energy-intensive and less emission-intensive than in the pre-transformation period, while against the background of some of the EU27 countries, which have divested their own production in favour of imports – the domestic added value coming from industrial production plays a relatively greater role in the Polish economy than on average in the whole EU. At the same time, the value of industrial output sold is increasing, almost doubling in the period 2005-2019, and increasing further during the post-pandemic economic rebound, exceeding 242% in 2022 compared to 2005.

Table 13. Selected industrial development indicators for Poland

Details	2005	2010	2015	2019	2020	2021	2022
Industrial production sold (constant prices) [2005=100]	100.0	133.1	161.5	196.9	193.2	221.6	242.2
Gross value of fixed assets in industry (constant prices) [2005=100]	100.0	122.0	157.0	186.2	195.3	203.3	210.0

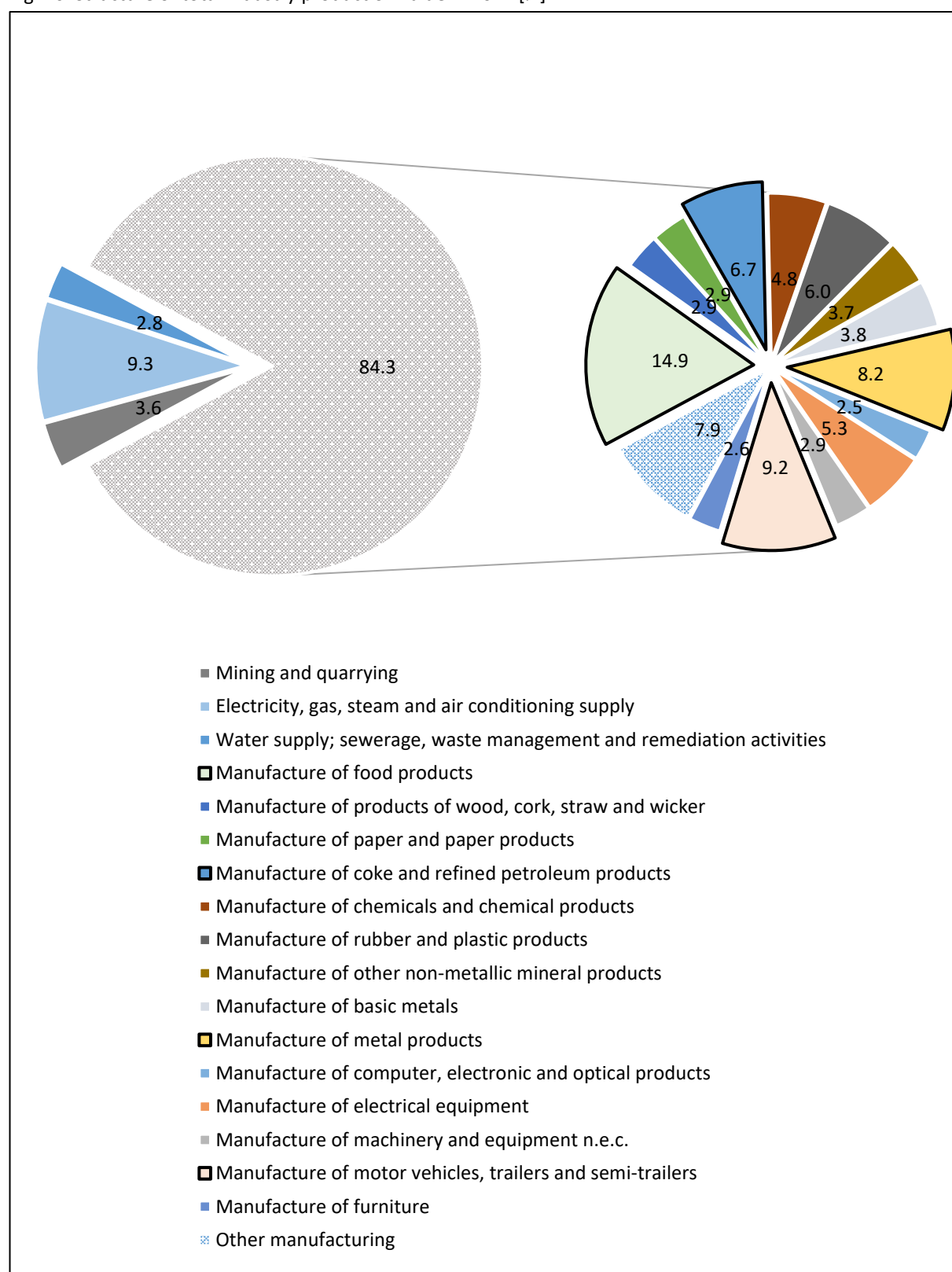
Source: Statistical Yearbook of the Republic of Poland, Statistics Poland 2010—2023

For years, exports of Polish industrial products have been directed mainly to EU MS, and in 2022 the share of this part of exports accounted for 76.6% of total domestic industry exports. The other export destinations were economically developed countries outside the EU (12.5%), economically developing countries (8.2%) and countries from the area of Central and Eastern Europe (2.7%). In turn, half of the imports of industrial products came from the EU27, while over 30% came from developing countries [Statistical Yearbook of Industry 2023, Statistics Poland 2023].

Thanks to the diversification of the industrial production structure, Polish economy is less prone to disruptions resulting from dependence on a single sector or a particular type of manufacturing. Among the numerous industries, foodstuffs (including beverages), petroleum processing, motor vehicles and other means of transport, electrical equipment, and the manufacture of metal, rubber and plastic products accounted for the largest share of production in 2022. The structure of the value of manufacturing output in 2022 is shown on Fig. 16, which distinguishes the above-mentioned types of manufacturing with individual shares above 5%. The only undistinguished value above 5%, at 7.9%, refers collectively to all other manufacturing output, i.e. to even more fragmented manufacturing in total.

In terms of the volume of energy consumption in process industries, the largest amounts, almost 70% of energy, are consumed by the combined production in the mineral, chemical, food and paper sectors (in 2022). In contrast, metallurgy, by reducing its energy intensity and limiting production, is no longer one of the sectors that consume the largest amounts of energy, whereas as recently as 2012 it was the industry using almost 12% of all energy consumed in industry [Energy efficiency in Poland 2012—2022, Statistics Poland 2024].

Fig. 16. Structure of total industry production value in 2022 [%]

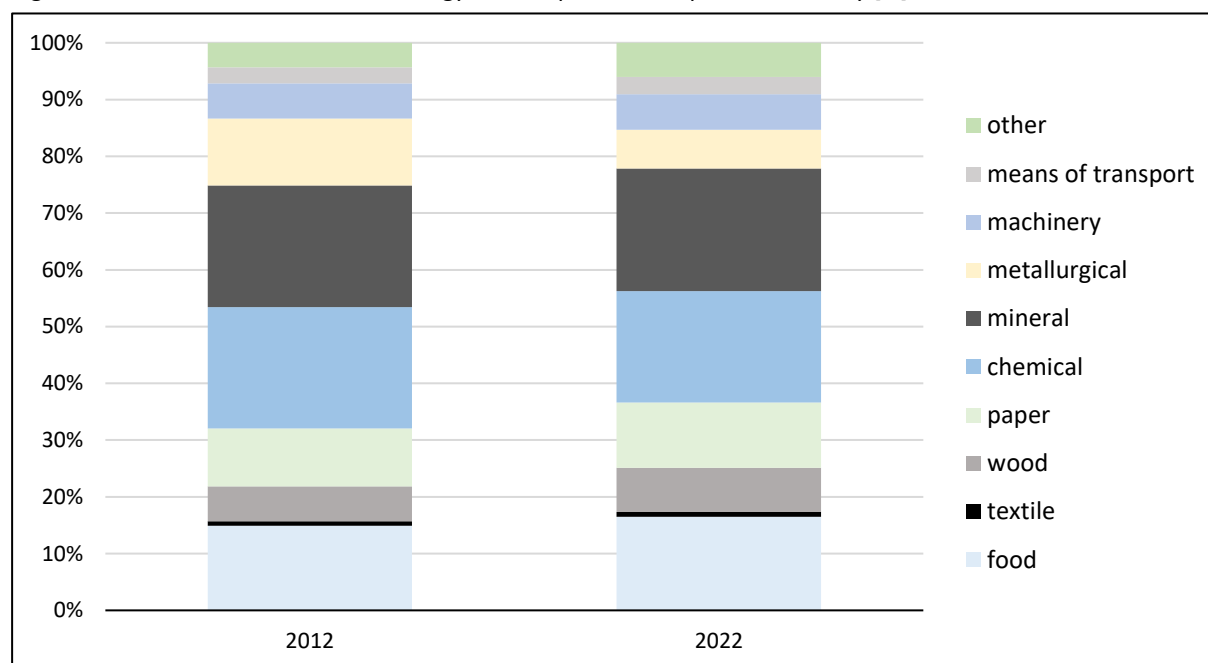


Source: study by KOBIZE, IEP-NRI, according to Statistics Poland data, Statistical Yearbook of Industry Poland 2023

The most energy-intensive industries, in terms of energy consumption per unit of product, are the metallurgical, mineral, chemical and paper sectors. Their production is of great importance to the country's economy, as evidenced by the fact that Poland ranks third in the European Union in terms of the production of e.g., refined copper, as well as cement. Reduction in the energy intensity of the

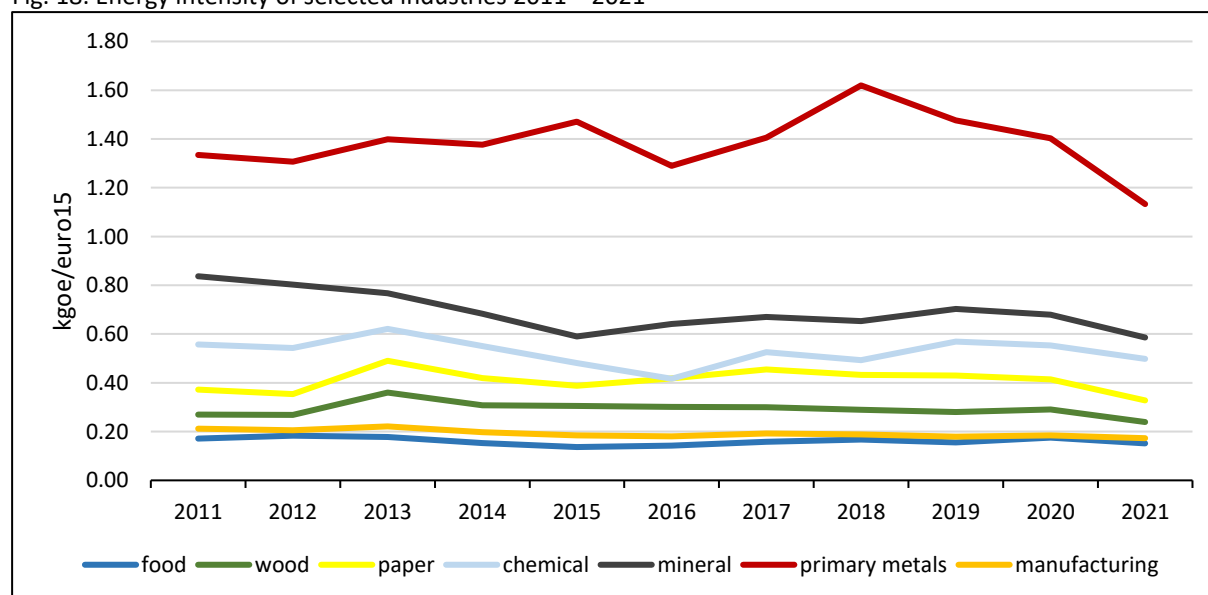
process industry took place at an average annual rate of 2.1% in the period 2012—2016. However, in 2017—2021, the rate of improvement was already weaker and amounted to 0.25%/year. The engineering, mineral and metallurgical industries reduced their energy intensity the most [Energy efficiency in Poland 2011-2021, Statistics Poland, Statistics Poland 2023].

Fig. 17. Divisional structure of final energy consumption in the process industry [%]



Source: study by KOBiZE, IEP-NRI, according to Statistics Poland, Energy efficiency in Poland 2012—2022

Fig. 18. Energy intensity of selected industries 2011—2021



Source: study by KOBiZE, IEP-NRI, according to Statistics Poland, Energy efficiency in Poland 2011-2021

1.6.4. Buildings and residential sector

There has been a steady increase in both single-family and multi-family residential buildings in Poland. The national housing stock at the end of 2022 was 15.6 million flats. There was an increase of 1.4% compared to 2021. The average number of persons per flat was 2.4, indicating a further slow decline

in the number of persons per flat, as, for example, the average was 2.6 in 2019, while in 2011 it was – more than 3 persons. In 2022, the average floor area per person increased by 0.7 m² to 31.1 m². Although, on average, flats in rural areas were significantly larger than in urban areas, there were, on average, 213 persons per 100 flats in urban areas, compared with 305 in rural areas [Housing Economy in 2022, Statistics Poland 2023].

Residential development is dominated by single-family buildings, primarily in rural areas. According to the results of the National Population and Housing Census 2021 in Poland [Statistics Poland 2023], single-family buildings accounted for 81.1% of buildings inhabited in urban areas, and as many as 97.5% in rural areas. However, the majority of flats, mainly in cities, were located in multi-apartment buildings, which contained 79% of urban flats and housed 70% of urban residents. In rural areas, on the other hand, over 89% of residents occupied single-family buildings.

Table 14. Housing stock by period of construction, as of 31 March 2021

Flats	before 1918	1918–1944	1945–1970	1971–1978	1979–1988	1989–2002	2003–2011	2012–2016	2017–2021	Under construction	No info available
[thous.]	967.8	1 305.9	3 045.8	1 843.6	2 176.2	1 880.5	1 377.7	761.4	888.3	46.3	247.1
[%]	6.7	9.0	20.9	12.7	15.0	12.9	9.5	5.2	6.1	0.3	1.7

Source: study by KOBIZE, IEP-NRI, according to Statistics Poland, *Housing conditions in Poland in the light of the results of the National Population and Housing Census 2021*, Statistics Poland 2023

Housing conditions in Poland are steadily improving, both in urban and rural areas. However, only one in five flats was built in the last 20 years, which means that the housing stock is in need of far-reaching modernisation, as one in three buildings was erected between 1945 and 1978, one in ten dated from 1918 to 1944, while almost 7% of buildings were built before 1918.

Table 15. Energy efficiency indicators in households 2011–2021

Details	Unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Consumption per flat	toe/flat	1.594	1.631	1.589	1.460	1.444	1.492	1.485	1.649	1.511	1.498	1.623
Consumption per flat with climate correction*		1.602	1.568	1.542	1.531	1.509	1.508	1.500	1.719	1.629	1.597	1.579
Total consumption per m ²	kgoe/m ²	22.0	22.4	21.7	19.9	19.6	20.2	20.1	22.2	20.3	20.1	21.8
Total consumption per m ² with climate correction*		22.1	21.5	21.1	20.9	20.5	20.4	20.3	23.2	21.9	21.5	21.2
Consumption for heating per m ²	kgoe/m ²	15.4	15.7	15.2	13.8	12.9	13.4	13.2	15.2	13.5	13.3	14.5
Consumption for heating per m ² with climate correction*		15.5	14.9	14.6	14.7	13.7	13.6	13.4	16.2	15.1	14.6	13.9
Electricity consumption per flat	kWh/flat	2242.5	2225.0	2213.8	2165.5	2159.7	2184.1	2179.0	2160.5	2139.5	2159.4	2276.8

*Climate correction is used to calculate energy consumption in a given year, assuming average weather conditions, based on the relationship between energy consumption and outdoor temperature.

Source: *Energy efficiency in Poland 2011–2021*, Statistics Poland 2023

Flats in rural areas are less well-equipped than in urban areas, which applies, for example, to access to the gas network: 73% of flats in urban areas were connected to it, while only 30% in rural areas. Subsequent years, however, bring a clear levelling off of the differences between rural and urban housing standards e.g., in the provision of mains water supply, as compared to the previous census in

2011, the number of mains watered rural flats increased by more than 12% [Housing conditions in Poland in the light of the results of the National Population and Housing Census 2021, Statistics Poland 2023].

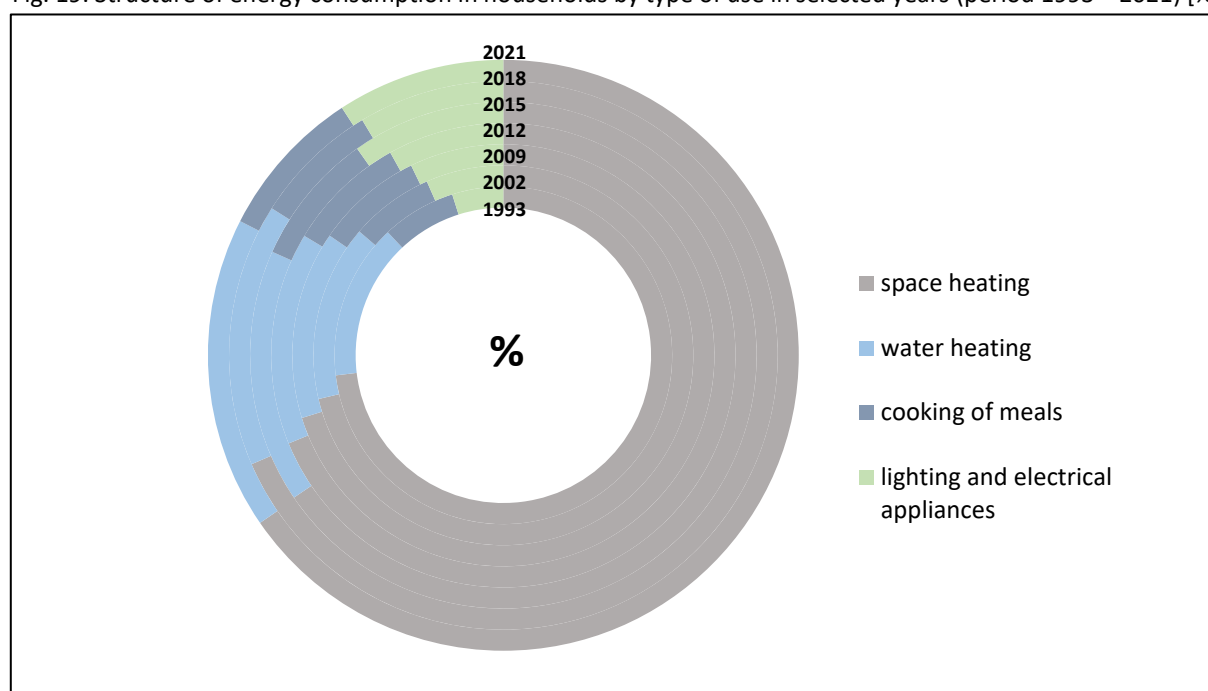
Households are one of the largest energy consumers in Poland, as they account for nearly 1/3 of final energy consumption. The share of households in final energy consumption decreased from 31.1% in 2011 to 29.4% in 2021. The most consumed energy carrier in households in 2021 was solid fossil fuels, which accounted for 21.9%, followed by natural gas (20.6%), district heating (18.3%), electricity (11.9%) and liquid fuels (2.8%). Consumption of other energy carriers including solid biofuels and ambient heat was 24.4% [Energy efficiency in Poland 2011-2021, Statistics Poland 2023]. On average, domestic households in 2021 consumed 24.6 GJ of energy per capita, which is at the European average level of 24.5 GJ per capita [Energy Consumption in Households in 2021, Statistics Poland 2023].

The energy consumed by households is used primarily for space heating. The climatic conditions in Poland, which are characterised by transience and variability, mean that the heating season, which is necessary for the proper functioning of society in most regions of the country, lasts from October to April inclusive, and often begins as early as September and ends in May. In addition, the variability of climatic conditions means that they are significantly different from one year to the next, with the result that there is a need to provide heating despite periodic fluctuations in temperature. However, despite these conditions, the structure of energy consumption is slowly changing, as the proportion of energy used for space heating is gradually decreasing. This is due to the installation of more efficient gas and electric appliances and is also linked to the progressive thermomodernisation of buildings and the introduction of stricter building standards. At the same time, the number of electrical appliances that households are equipped with is increasing, resulting in increased energy consumption for purposes other than heating. One of the many appliances is increasingly air conditioning.

District heating is a very important energy carrier in Poland, especially for inhabitants of large cities. It is precisely in the urban area that it has been the dominant heating medium for years, providing heat for three quarters of metropolitan flats, while in the country as a whole, district heating supplies 52.2% of all flats. District heating networks also provide users with hot water, which was used by 41.1% of households, i.e. 78.2% of consumers of district heating [Energy Consumption in Households in 2021, Statistics Poland 2023].

In the structure of energy consumption for residential needs, apart from district heating, solid fuels are the most important. In Poland, hard coal is mainly used, as well as firewood, used in one in five households, where it is generally burned in the same boilers and cookers as hard coal, either simultaneously with coal or interchangeably. Solid fuels were most commonly used for space heating in 2021, as 32.8% of households used them in this way. However, the share of these fuels is changing, especially coal, whose role has clearly decreased: while still in 2015 more than 40% of households were heated with coal, in 2021 – only around 21%. Solid fuels are also used for heating water in 22.5% of households and much less frequently – for cooking meals (1.7%) [Energy Consumption in Households in 2021, Statistics Poland 2023].

Fig. 19. Structure of energy consumption in households by type of use in selected years (period 1993—2021) [%]



Source: study by KOBiZE, IEP-NRI, according to Statistics Poland

Natural gas was used in 56.5% of households. Many multi-family buildings, especially in urban areas, were equipped with gas mains exclusively for cooking meals, so as many as 30.8% of consumers used it for this purpose and only 14.6% of users used it only for flat heating. Outside urbanised areas without a gas network, residents largely use liquid gas. This type of fuel was used by 2021 by 30.6% of households, almost entirely for cooking meals.

Table 16. Share of households using particular energy carriers for space heating [%]

Details	2012	2015	2018	2021
Electricity	5.4	4.5	5.1	5.5
District heating	41.5	41.7	40.4	52.2
Natural gas*	8.8	10.1	14.0	14.6
LPG (propane-butane)	0.3	0.3	0.5	0.8
Fuel oil	0.4	0.4	0.5	0.3
Hard coal	40.8	40.4	36.5	20.9
Lignite	1.4	1.1	0.5	0.4
Coke	0.7	0.8	0.6	0.2
Firewood	40	41.7	28.8	20.7
Other kind of biomass	4.3	3.0	1.3	2.3
Solar energy	0.07	0.15	0.13	0.40
Heat pump	0.05	0.07	0.28	0.69

* data for 2012 refers to high-methane gas

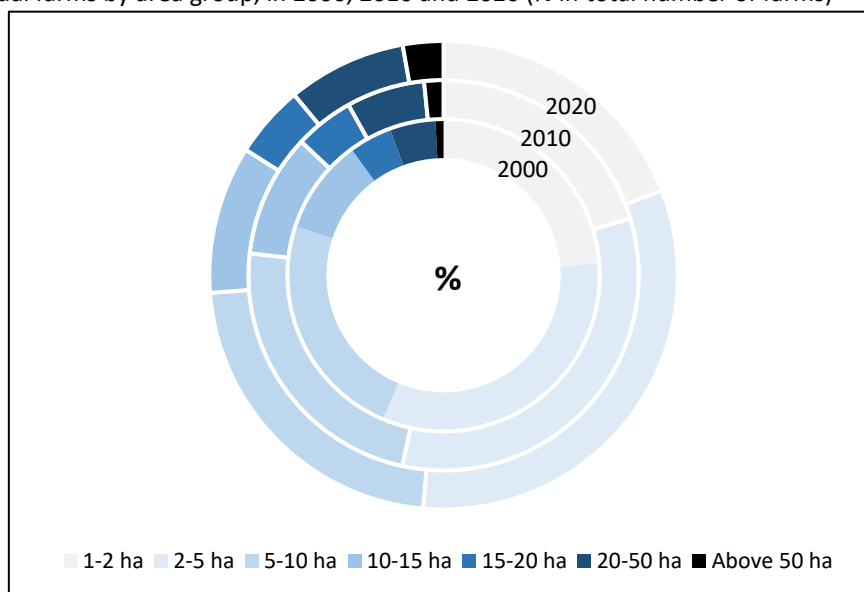
Source: Energy Consumption in Households in 2021, Statistics Poland 2023

In addition, there has been an expansion in the use of RES in households, with a growing proportion installing solar panels, photovoltaic panels and heat pumps. In 2022, households used 20.6 PJ of ambient heat captured by heat pumps [Energy from renewable sources in 2022, Statistics Poland 2023].

1.6.5. Agriculture

Agriculture in Poland is characterised by large land resources with a prevalence of poor and acidified soils, especially in the eastern and southern parts of the country. In Polish agriculture, although to a decreasing extent, the fragmentation of farms and traditional production methods still persist. Progressive changes result in the development and intensification of a significant part of the sector, especially in terms of commodity production. At the same time, the number of individual farms is declining, which in the period 2000–2020 decreased by over 600,000. In relation to the number of individual farms in 2000, their number decreased to approx. 78% in 2010 and to approx. 61% in 2020 [Statistical Yearbook of Agriculture and Rural Areas 2007, Statistics Poland 2007; Statistical Yearbook of Agriculture 2023, Statistics Poland 2023]. The decreasing number of farms, the average area of which is gradually increasing, is accompanied by a departure from work in the agricultural sector in favour of other professional activities. While the percentage of the number employed in agriculture (and forestry together) oscillated around 7–8% of the total workforce in 2020–2022, it was still almost 27% of the total workforce in the early 1990s [Statistical Yearbook of Agriculture 2023, Statistics Poland 2023].

Fig. 20. Individual farms by area group, in 2000, 2010 and 2020 (% in total number of farms)

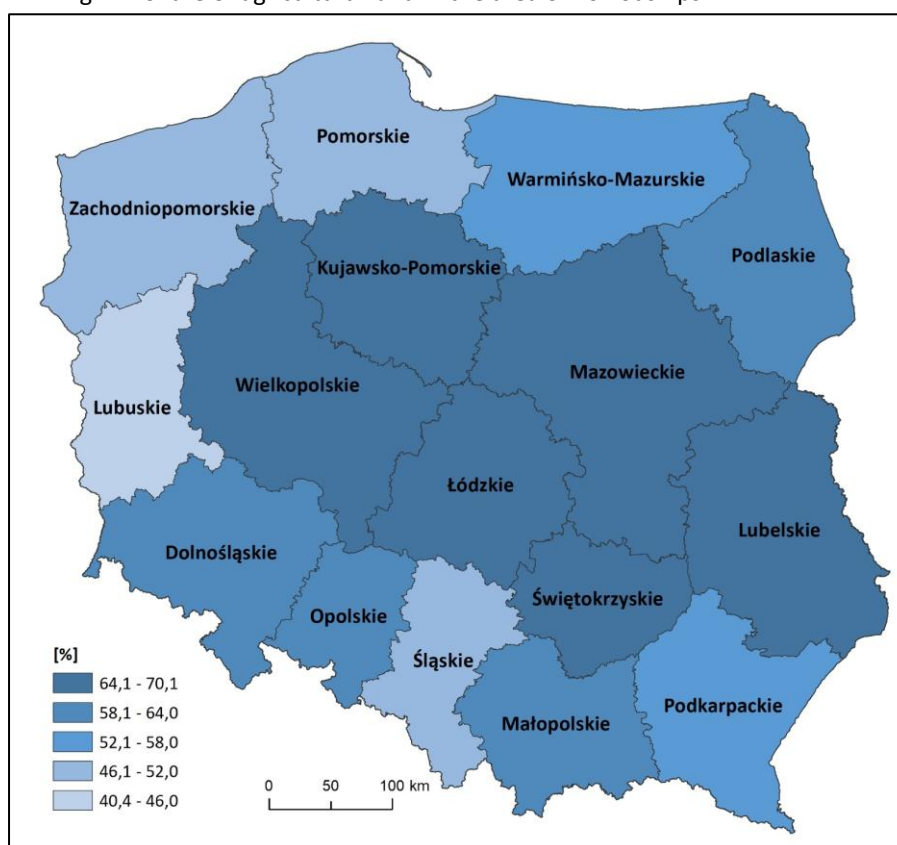


Source: study by KOBiZE, IEP-NRI, according to Statistics Poland: Statistical Yearbook of Agriculture and Rural Areas 2007, CSO 2007; Statistical Yearbook of the Republic of Poland 2021

The agricultural sector is subject to transformations, particularly visible in the period since 2004, i.e. since Poland's accession to the European Union. The main factors of transformation are the introduction of the instruments of the EU Common Agricultural Policy, changes in society's eating habits, the transition to other methods of livestock farming, the search for new sources of energy and increasingly visible climate change [Census of Agriculture 2020, Statistics Poland 2021].

In Poland, as of 1 January 2023, the agricultural area was 18.65 million hectares, which accounted for 59.4% of the country's territory, with 0.49 hectares of agricultural land per capita [Statistical Yearbook of Agriculture 2023, Statistics Poland 2023].

Fig. 21. Share of agricultural land in the area of voivodships



Source: study by KOBiZE, IEP-NRI, according to Statistics Poland, Statistical Yearbook of Agriculture 2023

Table 17. Selected data on agricultural development

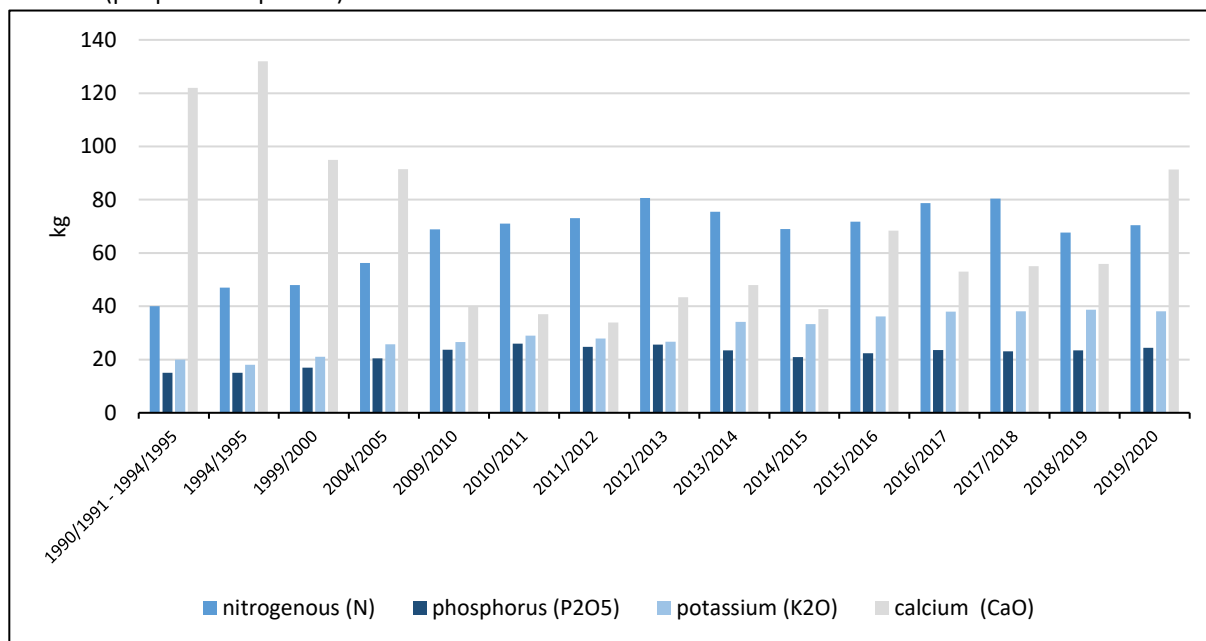
Details	1990	1995	2000	2005	2010	2015	2019	2020	2021	2022
Sown area [million ha]	14.2	12.9	12.4	11.2	10.4	10.8	10.9	11.0	10.9	11.0
Employed in agriculture and forestry as percentage of total employment [%]	26.8	27.7	27.8	16.6	16.8	16.1	14.8	7.7	7.6	8.4
Wheat yields per hectare [t]	3.96	3.60	3.23	3.95	4.43	4.57	4.39	5.33	5.07	5.34
Agricultural commodity production (constant prices) – 1995=100	.	100.0	109.0	121.3	138.1	153.4	165.5	168.3	164.8	171.4
Cow breeding [million head]	4.9	3.6	3.1	2.8	2.6	2.4	2.5	2.5	2.4	2.2
Beef meat production [thousand t]	652	329	291	275	373	441	530	531	531	511
Pork meat production [thousand t]	1,498	1,637	1,602	1,596	1,516	1,581	1,610	1,605	1,620	1,632
Poultry meat production [thousand t]	311	322	579	1,013	1,386	2,021	2,737	2,837	2,640	2,879
Cow's milk [billion l]	15.4	11.3	11.5	11.6	11.9	12.9	14.1	14.4	14.5	14.8
Hens' eggs [billion pieces]	7.6	6.3	7.6	9.6	11.1	10.5	12.1	11.7	11.0	11.9
Freshwater fish (catch) [thousand t]	48.9	29.7	38.7	54.1	45.1	50.4	59.8	63.1	57.0	56.8

Source: Statistical Yearbook of Agriculture 2023, Statistics Poland 2023

The level of mineral fertilisation and the consumption of chemical plant protection products and the degree of mechanisation, as manifestations of modernisation and intensification of production, are

gradually increasing, although they are still moderate in relation to Western European countries. An increase in the use of both mineral and calcium fertilisers is observed on farms as the area of land used increases. Mineral fertiliser consumption in all farms belonging to area groups above 20 ha of arable land was higher than the national average in 2020, with the highest – in farms above 100 ha, where it amounted to 170.5 kg NPK (nitrogen [N], phosphorus [P] and potassium [K]) per hectare of total agricultural land [Census of Agriculture 2020, Statistics Poland 2021].

Fig. 22. Mineral or chemical and calcium fertiliser consumption per ha of agricultural land, in selected years (per pure component)



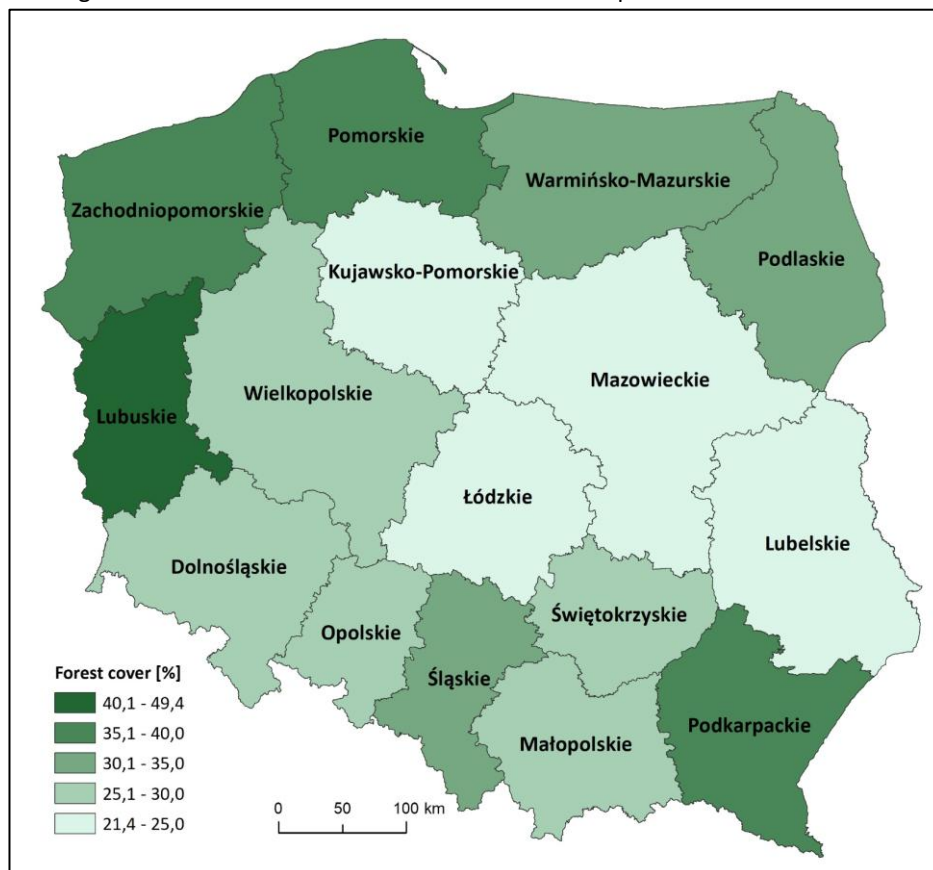
Source: study by KOBiZE, IEP-NRI, according to Statistics Poland, Statistical Yearbooks of the Republic of Poland 2001, 2014, 2016, 2021, 2023

The intensification of agricultural production is also expressed by a reduction in the area sown with a simultaneous increase in productivity, both in crop and livestock production. An example is the rise in wheat yields, which increased from 3.96 t/ha in 1990 to 5.34 t/ha in 2022, an increase of 35%. Many other indicators of agricultural production have also increased significantly, even in a shorter period of time. The average milk production increased from 4,487 litres per year per cow in 2010 to 6,647 litres per year in 2022, i.e. by 48% on average, and the average number of eggs increased from 227 to 249 eggs per laying hen. Poland is the largest producer in the EU of e.g., apples, whose harvest increased from 1.9 million t in 2010 to 4.3 million t in 2022, as well as poultry meat, whose production increased from 2 million t to 3.7 million t, respectively. The total value of agricultural commodity production is therefore growing, having increased by nearly 24% between 2010 and 2022 [Statistical Yearbook of Agriculture 2023, Statistics Poland 2023]. Consequently, the agricultural sector plays an important role in the national economy, ensuring food security for society, enabling the development of processing in the food industry and giving an essential contribution to trade. Such circumstances, however, make the potential reduction of GHG emissions from the sector faced with a number of insurmountable constraints.

1.6.6. Forests

The area of forest land in Poland in 2022 amounted to 9.48 million ha and increased by 9.3% between 1988 and 2022. The forest ratio of the country was 29.7% in 2022, with 0.246 ha of forest per Polish inhabitant [Statistical Yearbook of Forestry 2023, Statistics Poland 2023].

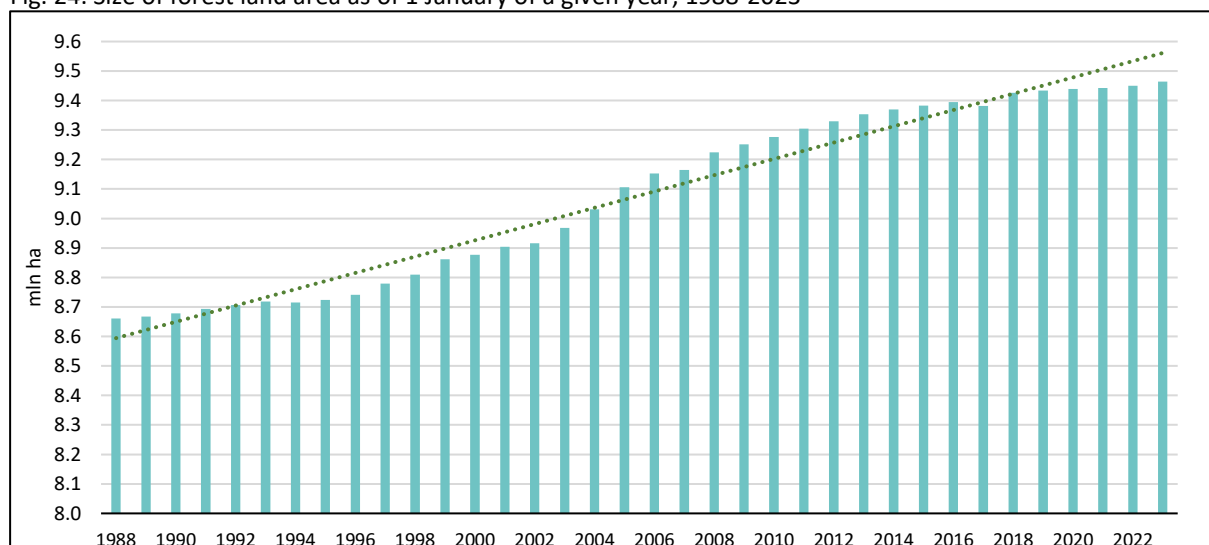
Fig. 23. Share of forest area in the area of voivodships



Source: study by KOBiZE, IEP-NRI, according to Statistics Poland 2023

The share of protection forest in the total forest area increased to over 41% in the period 1990—2022. The average age of forest stands is 61 years [Statistical Yearbook of Forestry 2023, Statistics Poland].

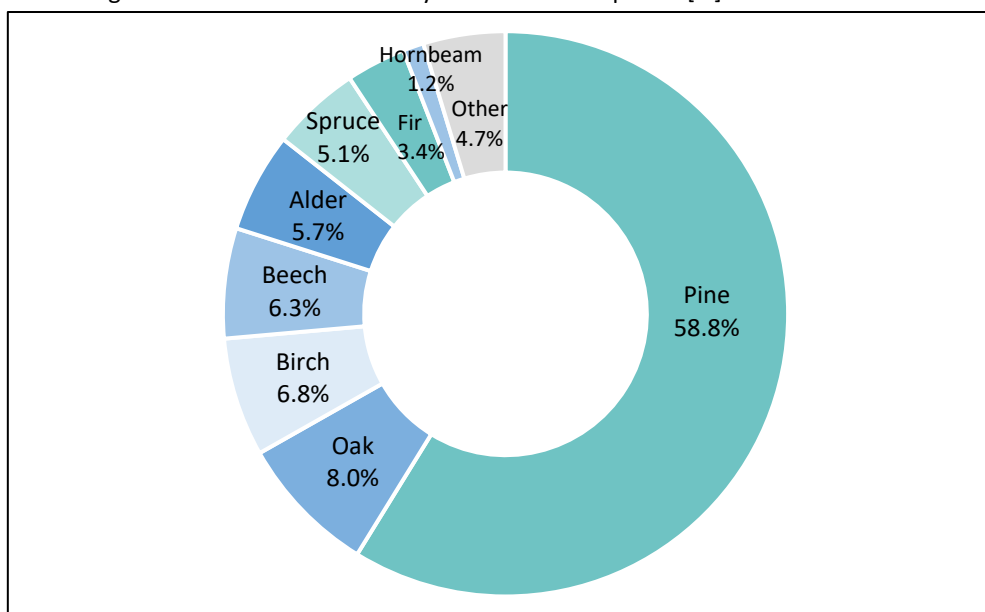
Fig. 24. Size of forest land area as of 1 January of a given year, 1988-2023



Source: study by KOBiZE, IEP-NRI, according to Statistics Poland, Environmental Protection 2023, NIR 2024

The increase in the forest area results from systematic afforestation of non-forest land previously used for agriculture or wasteland, as well as from the reclassification of other land covered with forest vegetation into forests (natural succession). However, a slowdown in the rate of afforestation of land is observed, mainly due to the depletion of free space for afforestation and change of use to other purposes. On the other hand, exclusions of forest land for non-forest and non-agricultural purposes are mainly related to the development of transport infrastructure, especially roads.

Fig. 25. Forest area structure by dominant tree species [%]



Source: study by KOBIZE, IEP-NRI, according to Statistics Poland, Statistical Yearbook of the Republic of Poland 2023

The most important functions of forests are natural, protective, productive (economic) and social ones. Forested areas suffer from pressure from soil drying and fires, which is why small retention reservoirs are created on their areas. The relatively large area on a national scale means that forests play an important role in mitigating the effects of climate change. However, in the long term, precisely because of climate change and the increasing impact of destructive factors such as droughts or hurricanes, combined with the changing age structure of Polish tree stands, forests may potentially become CO₂ emitters.

1.6.7. Waste

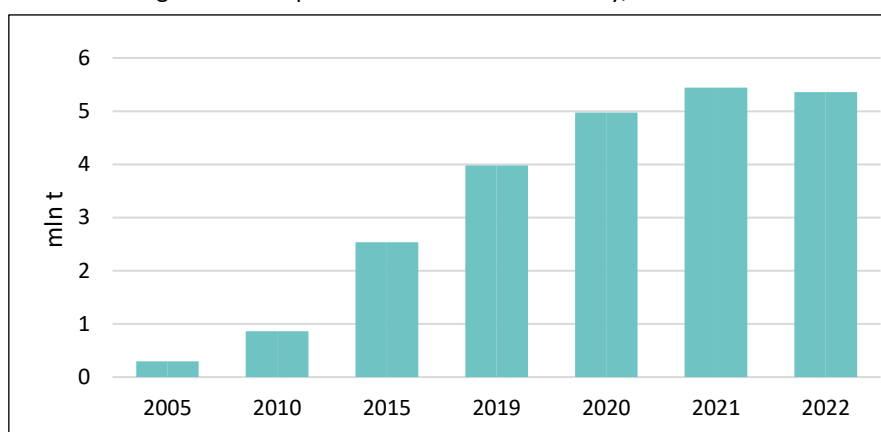
In 2022, 128.4 million t of waste was generated in Poland, of which nearly 90% was waste from various economic actions (115 million t), while 10.4% was municipal waste (13.4 million t). The amount of waste generated (excluding municipal waste) since 2000 has been in the range of 110-130 million t [Environmental Protection 2023, Statistics Poland 2023]. Mining and quarrying, industrial processing and electricity, gas, steam and hot water generation and supply remain the largest waste generators.

The amount of municipal waste generated by society depends e.g. on consumption patterns, so that Poland produces significantly less municipal waste per capita than the average across the EU. In 2022, there were 355 kg of municipal waste per capita in Poland, compared to the European Union average of 513 kg [Eurostat].

Municipal waste is collected selectively, and the amount of segregated waste is increasing. Up to 2010, there was only less than 1 million t, but already in 2015, more than 2.5 million t of waste had been

selected, and in 2020. - almost 5 million t. Between 2021 and 2022, the volumes of selectively collected municipal waste remain at just over or below 2.4 million t per year.

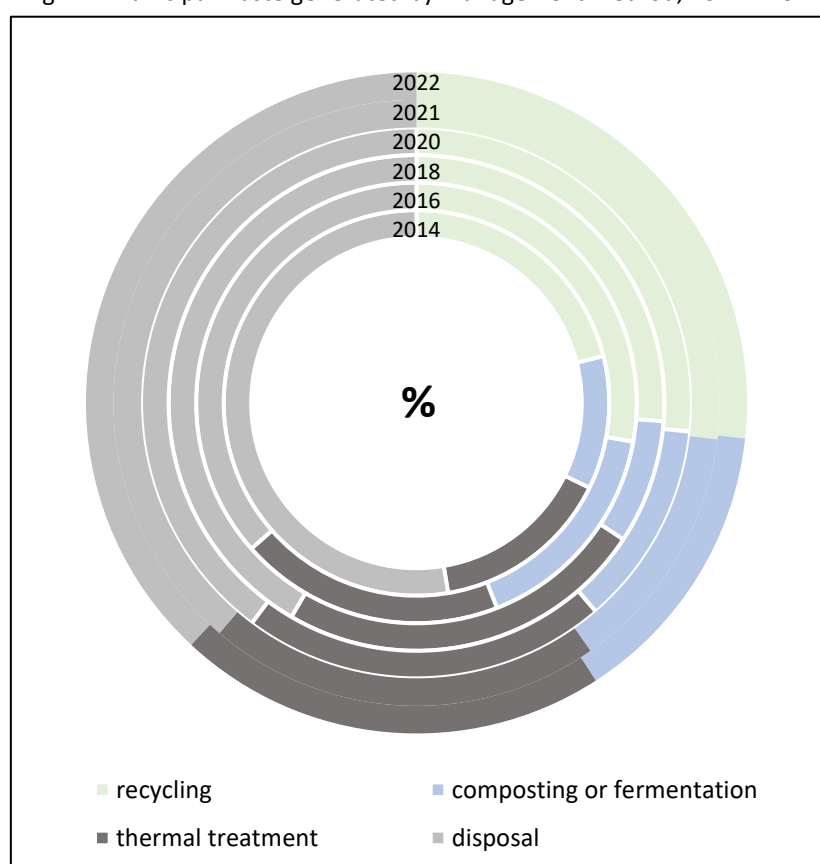
Fig. 26. Municipal waste collected selectively, 2005—2022



Source: Environmental Protection 2021, 2023, Statistics Poland 2023

In 2022, 27% of municipal waste was recycled, 14% was digested or composted, 21% was thermally treated and 38% was sent to landfill. The share of landfilling is steadily decreasing, while the role of recycling, composting and thermal treatment is increasing. The amount of total municipal waste in 2022 was 13.4 million t, down 2% on the previous year, while in previous years the amount of this waste gradually increased, from 10.3 million t in 2014 to 13.7 million t in 2021.

Fig. 27. Municipal waste generated by management method, 2014—2022

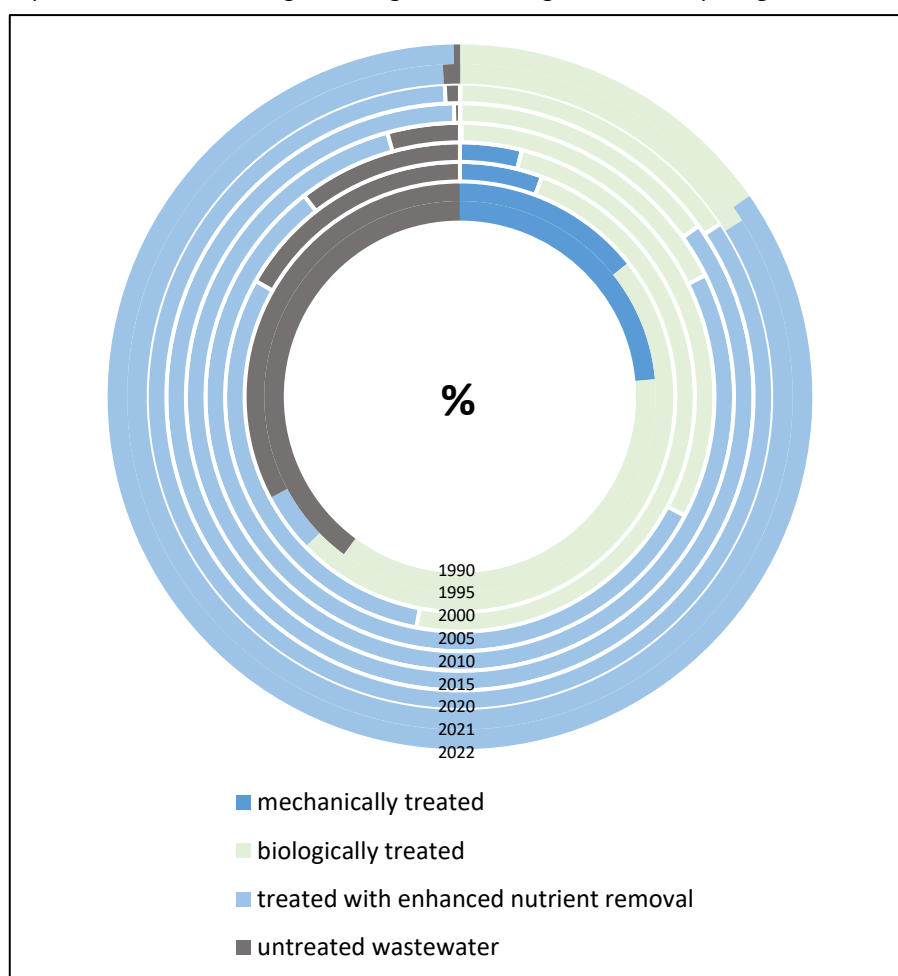


Source: study by KOBIZE, IEP-NRI, according to Statistics Poland, Environmental Protection 2015, 2017, 2019, 2021, 2023

The amount of municipal waste varies between rural areas and cities, as well as between regions of Poland, as it is almost twice as high in the western part of the country as in the eastern part, and the highest in tourist destinations, where municipal waste collection exceeds even 1,000 kg per capita. There is a systematic increase in selective waste collection, which in 2005 accounted for only 3% of collected municipal waste, and in 2022 already 40% of the total municipal waste generated.

In 2022, the largest volume of industrial wastewater requiring treatment arose in mining (40%) and industrial processing (also 40%). On the other hand, the generation and supply of electricity, gas, steam and hot water, from which a significant amount of wastewater does not require treatment as it is mostly cooling water generated mainly in thermal power plants, generated 10% of the amount of industrial wastewater requiring treatment. The remaining treated wastewater came mainly from processes related to water supply, wastewater and waste management and was the result of rehabilitation.

Fig. 28. Municipal wastewater discharged through the sewerage network requiring treatment, 1990–2022



Source: study by KOBIZE, IEP-NRI, according to Statistics Poland, Environmental Protection 1990–2023

In 2022, the volume of municipal wastewater requiring treatment reached a total of 1.4 billion m³. The predominant treatment process for municipal wastewater has become treatment with enhanced nutrient removal, which has almost completely displaced purely mechanical treatment. Incidental increases in the volume of wastewater not discharged to treatment plants are most often caused by breakdowns and natural disasters (floods).

1.7. Institutional arrangements

1.7.1. Institutional arrangements for tracking progress

The EU's Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action ('Governance Regulation')⁵ establishes a governance mechanism and specific arrangements to track the progress of the Union and its Member States towards the implementation and achievement of the EU's climate and energy targets and commitments under the UNFCCC and the Paris Agreement. These arrangements include the monitoring of GHG emissions and removals, the reporting of policies and measures, projections of GHG emissions and removals and progress on adaptation to climate change.

Under the Governance Regulation, the EU has established a Union Inventory System to ensure the timeliness, transparency, accuracy, consistency, comparability and completeness of the data reported by the EU and its Member States. This inventory system includes a quality assurance and quality control programme, procedures for setting emission estimates, and comprehensive reviews of national inventory data to enable the assessment of compliance towards climate goals.

Each EU Member State compiles its GHG inventory in accordance with the requirements of the Paris Agreement⁶ and the relevant Intergovernmental Panel on Climate Change (IPCC) guidelines⁷. Inventory data on GHG emissions and removals, including information on methods, are submitted electronically using a reporting system managed by the European Environment Agency (EEA). The submitted data are subject to quality control procedures and feed into the compilation of the GHG inventory of the EU. Net GHG emissions, calculated from emissions and removals reported in the GHG inventory of the EU, are the key information used for tracking progress towards the EU NDC target of a least -55% net emission reduction by 2030 compared to 1990.

Given the scope of the EU NDC related to international aviation and navigation, a specific share of international aviation and navigation emissions as reported in the GHG inventory data is calculated based on the Joint Research Centre's Integrated Database of the European Energy System (JRC-IDEES).⁸ Details on the methodology applied to identify GHG emissions from international aviation and navigation in the scope of the EU NDC, which are added to the national totals from the EU GHG inventory, are given in Annex II Appendix 2 to this BTR.

Under the Governance Regulation each Member State must report to the Commission biennially on the status of implementation of its integrated national energy and climate plans (NECPs). This process allows the Commission to ensure that the EU and the Member States remain on track to achieve the climate-neutrality objective and progress on adaptation. Under the Governance Regulation, Member States further operate national systems for policies and measures and projections and submit and report standardised information, which is subject to quality and completeness checks. Based on the

⁵ Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action, <http://data.europa.eu/eli/reg/2018/1999/oj>

⁶ Chapter II of the annex to decision 18/CMA.1, <https://unfccc.int/documents/193408> i [decyzji 5/CMA.3, https://unfccc.int/documents/460951](https://unfccc.int/documents/460951)

⁷ 2006 IPCC Guidelines for National Greenhouse Gas Inventories, <https://www.ipcc-nggip.iges.or.jp/public/2006gl/>, and on a voluntary basis: 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: <https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/>

⁸ European Commission, Joint Research Centre, Rózsai, M., Jaxa-Rozen, M., Salvucci, R., Sikora, P., Tattini, J. and Neuwahl, F., JRC-IDEES-2021: the Integrated Database of the European Energy System – Data update and technical documentation, Publications Office of the European Union, Luxembourg, 2024, <https://publications.jrc.ec.europa.eu/repository/handle/JRC137809>.

submitted data, the EEA compiles projections of GHG emissions and removals for the EU. The EU-wide information is summarised annually in the Climate Action Progress Report⁹ by the European Commission and in the 'Trends and projections' report by the EEA¹⁰. Both the Union and the national systems are subject to continuous improvements.

The national energy and climate plans (NECPs) were introduced by the Governance Regulation. For Member States, the NECP for 2021-2030 play a key role to enabling the tracking of progress towards the 2030 climate and energy targets. The update of the NECPs provides an opportunity for Member States to assess their progress, identify gaps and revise existing measures or plan new ones where needed.

Member States were due to submit their final updated NECPs, taking account of the Commission's assessment and recommendations, by 30 June 2024.

The Minister of Climate and Environment is responsible for the area of climate policy. This applies also to the monitoring and evaluation of progress in the implementation of climate policy, including climate protection policies and measures and GHG emission reduction targets. The implementation of these tasks is regulated by the *Act of 17 July 2009 on the system to manage the emissions of greenhouse gases (GHGs) and other substances* (hereinafter 'the Act of 17 July 2009')¹¹, which established a system for the inventory, monitoring, reporting and forecasting of GHG emissions. It also created the legal basis for managing the national GHG emission cap in a way that ensures Poland's compliance with its international and EU obligations and enables optimisation of emission reduction costs.

As a EU MS, Poland also participates in the EU Emissions Trading System (EU ETS), which is a key element of the European Union's climate change policy, being the primary tool for reducing GHG emissions. In 2022, 565 domestic installations were covered by the system, as well as operators from the aviation sector. The functioning of the system in Poland is regulated by the Act of 12 June 2015 on the GHG Emission Trading System (hereinafter 'the Act of 12 June 2015')¹².

The main element of the GHG emissions inventory, monitoring, reporting and forecasting system, established under the Act of 17 July 2009, is the National Centre for Emission Management (KOBiZE) at the Institute of Environmental Protection – National Research Institute (IEP-NRI). In accordance with the Act of 17 July 2009, the KOBiZE, IEP-NRI, performs various tasks for the Minister of Climate and Environment that relate to climate policy. These include:

- carrying out work related to the functioning of the national system of balancing and forecasting emissions, including the maintenance of the National Database on GHG and other substance emissions;
- preparing emission inventories and projections;
- preparing analyses and reports on climate protection policies and measures;
- administering the Polish part of the Union Registry and maintaining the National Registry of Kyoto units;
- performing the tasks of the national administrator of the GHG emission trading system (EU ETS).

In connection with the above specified tasks, the KOBiZE, IEP-NRI, performs an annual national GHG emission inventory, develops GHG emission projections, monitors policies and measures implemented

⁹ Climate Action Progress Report 2024, COM(2024) 498 final (within the framework of the energy union reporting set out in the Governance Regulation), [Progress on climate action - European Commission](#).

¹⁰ Trends and Projections in Europe 2024, [Trends and projections in Europe 2024 | European Environment Agency's home page](#).

¹¹ Journal of Laws of 2022, item 673.

¹² Journal of Laws of 2024, item 1505.

in the area of climate protection, and drafts governmental (NC) and biennial (BR) reports and cyclical reports on climate protection policies and measures required by EU law. The KOBiZE analyses emission levels and trends in relation to the size of national emission limits in the non-ETS area, expressed in units of annual emission allocations (AEA). Poland, like all other EU MS, meets its individual targets only in the non-ETS area. These are set out in the ESD Decision¹³ (for 2013-2020) and the ESR Regulation¹⁴ (for 2021-2030).

Work for the GHG emission inventory, including the calculation of emission levels, selection and development of methodologies, selection of emission source activities and determination of emission factors, is carried out at the KOBiZE. During the preparation of the inventory, the KOBiZE establishes cooperation with individual experts and institutions, which include Statistics Poland, Agencja Rynku Energii S.A., the Polish Geological Institute – National Research Institute, the Institute for Ecology of Industrial Areas, the Bureau for Forest Management and Forestry. The aforementioned institutions are primarily involved in providing data on activity in the respective sectors.

In addition, experts of the KOBiZE, have access to emission data submitted by companies participating in the EU ETS. These verified data are used in some sectors in the GHG emission inventory (e.g., in the subcategories of industrial processes). In addition, the inventory team has access to emission data submitted by individual entities to the National Database on GHG and other substance emissions¹⁵ – the largest database available in Poland, to which almost 60,000 entities in 2023 (about 57,000 entities in 2022) submitted reports on emissions from about 155,000 installations.

In order to further ensure the high quality of the national GHG emissions inventory, a *National Quality Assurance and Quality Control (QA/QC) Programme* for the GHG inventory has been developed. The QA/QC programme defines the tasks, responsibilities as well as the timetable for the execution of QA/QC procedures and is presented in the annual National Inventory Reports (NIR)¹⁶. An additional element of the system is the Inventory Improvement Plan, which is updated on an ongoing basis. It primarily covers methodological aspects, both for GHG emissions and air pollutants, resulting from the process of international inventory reviews, internal and inter-ministerial consultations. Priority is given to major emission sources for which, where possible, national methodologies and emission factors are developed. The unit responsible for the coordination and implementation of QA/QC procedures in the national inventory is the KOBiZE.

Supervision of the performance of the tasks carried out by the KOBiZE is exercised by the minister in charge of climate and environmental affairs. Before official notification, the national inventory undergoes an approval process at the Council of Ministers. The entity responsible for accepting the results of the inventory is the Minister of Climate and Environment.

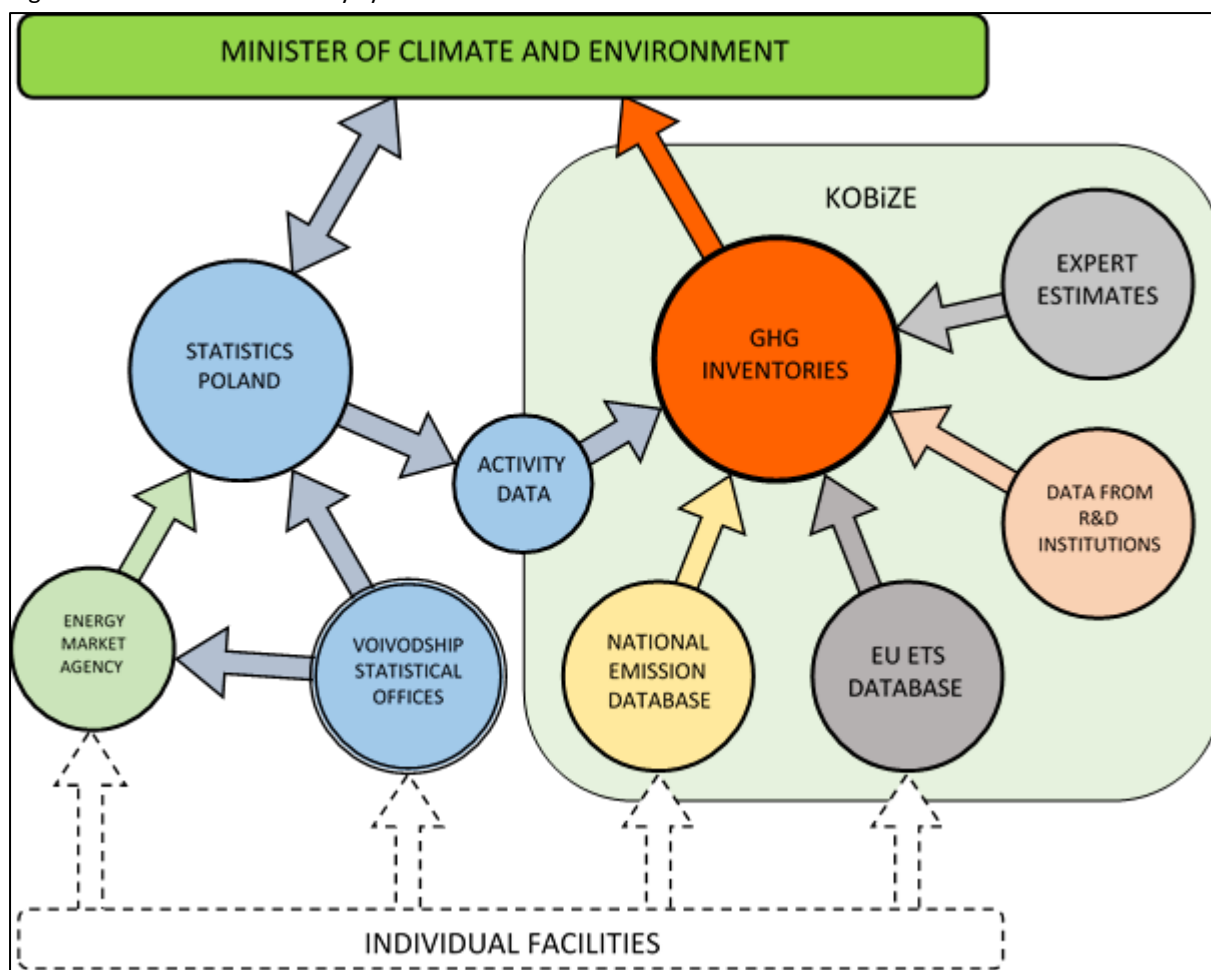
¹³ Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020, the so-called 'ESD Decision', <https://eur-lex.europa.eu/eli/dec/2009/406/oj>

¹⁴ Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013, the so-called 'ESR Regulation', <https://eur-lex.europa.eu/eli/reg/2018/842/oj>

¹⁵ National Database: <https://krajowabaza.kobize.pl/>

¹⁶ National Inventory Report 2024: Synthesis Report, https://www.kobize.pl/uploads/materialy/materialy_do_pobrania/krajowa_inwentaryzacja_emisji/NIR_2024_raport_synetyczny_PL.pdf

Fig. 29. National GHG inventory system scheme



Source: study by KOBIZE, IEP-NRI, NIR 2024

As already mentioned, due to the scope of the EU NDC, inventory data on GHG emissions is supplemented by data collected in the EU Registry (under the EU ETS). The Polish Registry was launched in July 2006, and since 2008 it has been linked to the International Transaction Log (ITL) and to the European Union Transaction Log (EUTL), which serves as an additional transaction log. The administrator of the registry, in accordance with national regulations, is the KOBIZE. The registry database stores information on covered by system entities, installations, verified emissions, national holding accounts, installation accounts, aircraft operator holding accounts and trading accounts. The provider and technical operator of the common registry in terms of software and infrastructure is the European Commission. The administrator of the Polish part of the Union Registry is the KOBIZE.

In addition to emission inventories, KOBIZE performs GHG emission projections. These are submitted to the minister in charge of climate and environment, who subjects them to internal and inter-ministerial consultations. This process ensures that the assumptions used in the projections are consistent with ongoing and planned sectoral actions, which are carried out by the relevant ministers. The emission projections, after government agreement and approval, are forwarded to the EC and the UNFCCC Secretariat.

In accordance with the Act of 17 July 2009, the entrusting of the above-mentioned tasks to the KOBIZE, for both climate and air protection, contributes to the integration of the environmental reporting system related to these two areas, and thus ensures the appropriate quality of information provided

to national, EU and international centres in terms of accuracy, consistency, comparability and completeness.

Information on the implementation of climate policy is publicly available, inter alia, under the Act of 17 July 2009, through the publication of various information, reports and analysis results by the KOBIZE on its website¹⁷. In addition, key documents are published on the website of the Ministry of Climate and Environment, while legal acts are publicly available on the Internet system of legal acts. Poland has also established a system for managing the national GHG emission limit, which, in accordance with the Act of 17 July 2009, assists the Minister of Climate and Environment in the optimal way of accounting for emissions within the annual emission allocation (AEA).

1.7.2. Institutional arrangements for implementation of the NDC

The EU and its MS have set up a comprehensive system for the implementation of the EU climate change mitigation targets. The European Climate Law¹⁸ sets the goal of climate neutrality by 2050 and the intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. These targets cover emissions and removals that are regulated in the Union law.

To ensure that the EU and its Member States achieve their target, the 2030 Climate and Energy Framework was put in place. The main policies of this framework are the EU Emissions Trading System (EU ETS)¹⁹, which caps GHG emissions in energy, industry, aviation and maritime transport; the LULUCF Regulation which includes national net removal targets for the LULUCF sector; and the Effort Sharing Regulation (ESR) which establishes national reduction targets for GHG emissions not covered by the EU ETS or the LULUCF Regulation i.e. domestic transport (excluding aviation), buildings, agriculture, small industry and waste. The implementation of the ESR is supported by additional sectoral policies and measures (*details can be found in Ch. III. 4 Mitigation policies and measures, actions and plans, including those with mitigation co-benefits resulting from adaptation actions and economic diversification plans, related to implementing and achieving a nationally determined contribution under Article 4 of the Paris Agreement*). The legislative acts under the 2030 Climate and Energy Framework require the European Commission and the EU Member States to set up the institutional arrangements for implementing the specific policies and measures.

The revised EU ETS Directive increases the level of ambition in the existing system from 43% to 62% emissions reductions by 2030, compared to 2005 levels and extend the system to also apply to international maritime transport. A separate carbon pricing system will apply to fuel combustion in road transport and buildings and small-emitting sectors (ETS2) with a 42% emission reduction target compared to 2005 across the sectors covered. The amended Effort Sharing Regulation (ESR) increased, for the sectors that it covers, the EU-level GHG emission reduction target from 29% to 40% by 2030, compared to 2005, which translates in updated 2030 targets for each Member State. The new LULUCF Regulation sets an overall EU-level objective of 310 Mt CO₂ equivalent of net removals in the LULUCF sector in 2030.

¹⁷ <https://www.kobize.pl/>

¹⁸ Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'), <http://data.europa.eu/eli/reg/2021/1119/oj>

¹⁹ This refers to the ETS1, i.e. the Emission Trading System for stationary sources (Chapter III of the ETS Directive) and for aviation and maritime transport (Chapter II of the ETS Directive)(ETS1). Note that the 'Emissions trading system for buildings, road transport and additional sectors' (ETS2), added in 2023 as Chapter IVa of the ETS Directive, forms an instrument under the Effort Sharing Regulation (ESR).

The ESR sets national targets for the reduction of GHG emissions in the Member States by 2030. Member States are also subject to gradually decreasing annual emission limits for each year from 2021 to 2030. The annual progress towards the national targets under the Effort Sharing Legislation is assessed by comparing GHG emission levels from the sectors covered by the ESR with the relevant annual emission allocations under the legislation (AEAs). To achieve compliance under the ESR, Member States are permitted to use flexibility options to a certain extent.

Progress in the implementation of these policies and measures is monitored under the Governance Regulation. Relevant information which is reported regularly and archived at the EEA include GHG inventories, approximated GHG inventories for the previous year, information on policies and measures, projections, and progress towards the implementation of integrated National Energy and Climate Plans (NECP). This information helps the EU and its Member States to correct their course if progress towards the targets of the 2030 Climate and Energy Framework is behind schedule. As an example, the European Commission assesses the drafts of new or updated NECPs and provides recommendations for improved planning and implementation. In addition, the reported information is subject to quality checks, and the GHG inventories reported by EU Member States are subject to comprehensive reviews in 2025, 2027 and 2032.²⁰

All EU legislation, including the legislation under the 2030 Climate and Energy Framework, is subject to a stakeholder engagement process. So-called 'better regulation tools' ensure that policy is based on evidence and the best available practice²¹. During the preparation of legislative proposals, the European Commission invites citizens, businesses and stakeholder organisations to provide their views on the subject of the new legislation. These comments are documented in a dedicated portal²², and the European Commission reports on how it takes these comments into account in the development of the legislative proposals. Furthermore, the Governance Regulation sets requirements for Member States to ensure that the public is given early and effective opportunities to participate in the preparation of the NECPs.

Poland, as one of the EU MS, is obliged to meet the targets set out in the 2030 EU Climate and Energy Framework and participates directly in the actions indicated above by fulfilling e.g., the reporting obligations imposed on it (Emission Inventory, Emission Projections, Policies and Measures, NECP, NECP Implementation Reports). As already highlighted, these targets coincide with those declared by Poland together with other EU MS under the first EU NDC.

The basic legal document regulating matters related to the fulfilment of obligations, monitoring, reporting, archiving of information and assessment of progress in achieving reduction targets is the Act of 17 July 2009²³ defining e.g., the tasks of the National Centre for Emission Management (KOBiZE), IEP-NRI. For more information, see Chapter III.1.7.1. Institutional arrangements for tracking progress.

The system in place in Poland for the adoption of policies, strategies and other planning and development documents and legal acts by the Council of Ministers ensures that the sectoral policies implemented are mutually consistent with each other, and that they fulfil the objectives that Poland

²⁰ Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the 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 of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council (consolidated text, 2023), <https://eur-lex.europa.eu/eli/reg/2018/1999/2023-11-20>

²¹ Decision-making process: https://european-union.europa.eu/institutions-law-budget/law/how-eu-policy-decided_en

²² Have your say – Public consultation and feedback: https://ec.europa.eu/info/law/better-regulation/have-your-say_en

²³ Journal of Laws of 2022, item 673.

has adopted under national, EU and international agreements. When government policies are drafted, each of them goes through a process of inter-ministerial consultations, which allow the comments and suggestions of ministers in charge of various government departments to be taken into account. Such a system eliminates the risk that a given sectoral policy will not address the need to implement commitments for which another minister is responsible in the Polish government.

In addition, any draft legislation or document of a planning and strategic nature, such as national and sectoral development strategies, plans and programmes in the area of climate protection (as in any other area), is subject to public consultation.

The Council of Ministers conducts public consultations in two separate processes:

- in the course of public consultation, the draft is presented to social organisations or other interested entities or institutions whose opinion is desirable in view of the content of the draft document,
- in the course of opinion-forming, the draft is submitted to specific entities when such an obligation results from separate regulations or when it concerns the activity of such entities.

Maintaining a dependable and up-to-date national GHG emission inventory system (described in more detail in Chapter III.1.7.1. Institutional arrangements for tracking progress) allows for ongoing analysis of the implementation of the targets set under the EU NDC. At the same time, in accordance with the provisions of EU law, Poland, as well as other EU MS, is obliged to develop and implement the National Energy and Climate Plan (NECP), which is the key document defining the implementation of Member State targets for 2030, including the reduction of GHG emissions. The first Polish NECP for 2021—2030, submitted to the EC on 30 December 2019, was developed in fulfilment of Poland's obligation as a Member State under the Governance Regulation²⁴. The document has been prepared to provide a coherent basis for a sustainable, economically efficient and equitable transformation of the energy sector in Poland and the Polish economy as a whole. The Polish NECP is designed to enable synergies in the implementation of activities in the interrelated five dimensions of the Energy Union, taking into account the 'energy efficiency first' principle. The Energy Union is based on five pillars: energy security, an integrated internal energy market, energy efficiency, decarbonisation of the economy and research and innovation. As decarbonisation is one of them, Member States are expected to show in the NECP how they will meet the targets in non-ETS, as this is an important part of the contribution to the EU NDC. The document describes the national goals and targets of Poland's energy and climate policy, as well as the policies and measures to achieve them. The NECP was prepared taking into account the conclusions from inter-ministerial and public consultations, updates of the national sectoral strategies set out in the *Strategy for Responsible Development for the period up to 2020 (including the perspective up to. 2030)*, as well as regional consultations and EC recommendations²⁵.

Work is currently underway to update the 2019 NECP. Poland has prepared a preliminary version of its NECP update, which was submitted to the European Commission on 1 March 2024.²⁶ The document presents the first of the two required analytical scenarios, i.e. the baseline scenario (WEM, with

²⁴ Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the 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 of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council (OJ L 328, 21/12/2018, p. 1–77, as amended), Governance Regulation.

²⁵ included in document C(2019) 4421.

²⁶ Integrated National Energy and Climate Progress Report – Version 2023, <https://www.gov.pl/web/klimat/krajowy-plan-na-rzecz-energii-i-klimatu>.

existing measures). The WEM scenario reflects the current assessment of Poland's possible contribution to the 2030 EU Climate and Energy Framework. The trajectory enabling Poland to achieve a GHG emission reduction target close to the EU (i.e. 55%) will be presented in a more ambitious scenario (WAM, with additional measures), which is currently under development at the Ministry of Climate and Environment. A target document containing two scenarios, a baseline (WEM) and an ambitious scenario (WAM), will be submitted for full public consultation and inter-ministerial agreement. It is planned that the final version of the NECP update will be submitted to the EC in early January 2025. In addition, under the Governance Regulation, NECP reports are submitted to the EC on a biennial basis, with GHG emission projections and information on policies and measures forming an integral part of them.

2. Description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates

The European Union and its Member States were among the first Parties to the Paris Agreement to submit their draft Intended Nationally Determined Contribution (INDC). A few months before the adoption of the Paris Agreement, the EU and its MS in their INDC pledged to reduce GHGs by at least 40% by 2030 compared to 1990 emission levels²⁷. The EU's initial contribution became the official NDC (Nationally Determined Contribution) after the Union ratified the Paris Agreement in October 2016²⁸. In 2020 EU modified its first contribution to the Paris Agreement and reported a new reduction target consistent with the prospect of achieving climate neutrality in 2050 and increased the ambition of declared GHG emission reductions by 2030 by at least 55% compared to 1990²⁹. This first update of the Union's NDC was based on the European Green Deal strategy presented by the European Commission in 2019³⁰.

Subsequently, the EU's GHG emission reduction targets were set so that the EU is on a pathway towards a low-carbon economy, as outlined by the European Commission in its Communication on a long-term vision for 2050³¹. On 6 March 2020, the EU submitted its 2050 long-term strategy to the United Nations Framework Convention on Climate Change (UNFCCC).

By contrast, in 2021, the EC published the 'Fit for 55' package³², containing legislative proposals to ensure that the EU will meet its increased GHG emissions reduction target for 2030, a reduction of at least 55% compared to 1990, and will achieve its goal of climate neutrality by 2050. As a consequence of the above, in line with the European Council decision of December 2020, the EU increased its GHG emission reduction target declared in the NDC to at least -55% by 2030 compared to 1990. This target is also defined in EU regulations – the European Climate Law (Regulation 2021/1119)³³. It is currently being implemented through the revised EU ETS, non-EU ETS sectors and LULUCF legislation. The increased EU reduction commitments in the various pillars are as follows:

²⁷ Submission by Latvia and the European Commission on behalf of the European Union and its Member States: Intended Nationally Determined Contribution of the EU and its Member States, Riga, 6 March 2015, <https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Latvia/1/LV-03-06-EU%20INDC.pdf>

²⁸ Ratification status of the Paris Agreement, UN, https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&clang=en

²⁹ The update of the nationally determined contribution of the European Union and its Member States, 17 December 2020, https://unfccc.int/sites/default/files/NDC/2022-06/EU_NDC_Submission_December%202020.pdf

³⁰ Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, the European Green Deal, COM/2019/640 final dated 11 December 2019, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN>

³¹ Opinion of the European Economic and Social Committee on 'Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank Clean Planet for all A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy' (COM(2018) 773 final), <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52018DC0773>

³² Opinion of the European Economic and Social Committee on Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: 'Fit for 55': delivering the EU's 2030 Climate Target on the way to climate neutrality [COM(2021) 550 final], 14 July 2021, <https://eur-lex.europa.eu/legal-content/PL/TXT/?uri=CELEX%3A52021DC0550>

³³ Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'), <https://eur-lex.europa.eu/legal-content/pl/TXT/?uri=CELEX%3A32021R1119>

- target for the EU ETS area (including aviation and shipping) – 62% reduction in GHG emissions compared to 2005 (Directive 2023/959)³⁴;
- target for the non-EU ETS area (non-ETS area, ESR) – 40% reduction in emissions by 2030 compared to 2005 (Regulation 2023/857)³⁵;
- LULUCF area target – assurance by MS that GHG emissions will not exceed removals in this area between 2021 and 2025 and an overall net removals target in 2030 (-310 Mt CO₂) with an allocation mechanism for national targets in the period 2026-2030 (Regulation 2023/839)³⁶.

Under the current EU regulations, Poland was originally required to achieve a 7% reduction by 2030 relative to 2005 in the area of sectors not covered by the EU ETS. However, due to an increase in the ambition of the EU 2030 goal, the target for Poland agreed in the amendment to the Regulation 2018/842 was raised to -17.7% relative to 2005. The historical evolution of Poland's and the EU's GHG emission reduction commitments is presented in Table 18.

The first EU NDC was last updated in October 2023 and its scope reflects the most up-to-date EU climate and energy policy.

The NDC consists of a target to be met by a single-year target and is intended to cover an economy-wide absolute emission reduction. Poland joined the Paris Agreement as a member of the European Union and therefore did not submit an individual NDC to the UNFCCC. However, it participates in the EU's collective efforts to achieve its declared GHG emission reductions. The scope of the NDC covers the 27 EU Member States. Details of the EU NDC can be found in Table 19.

³⁴ Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading system, <https://eur-lex.europa.eu/legal-content/pl/TXT/?uri=CELEX%3A32023L0959>

³⁵ Regulation (EU) 2023/857 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement, and Regulation (EU) 2018/1999, <https://eur-lex.europa.eu/legal-content/PL/TXT/?uri=CELEX%3A32023R0857>

³⁶ Regulation (EU) 2023/839 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2018/841 as regards the scope, simplifying the reporting and compliance rules, and setting out the targets of the Member States for 2030, and Regulation (EU) 2018/1999 as regards improvement in monitoring, reporting, tracking of progress and review, <https://eur-lex.europa.eu/legal-content/PL/TXT/?uri=CELEX%3A32023R0839>

Table 18. Summary of GHG emission reduction targets of Poland and the EU for the period 2008—2030

	International commitments (UNFCCC)			EU law				
	Kyoto Protocol (KP)		Paris Agreement	Energy and climate package 2020		Energy and climate package 2030		
				EU ETS	ESD (non-ETS)	EU ETS	ESR (non-ETS)	LULUCF
	Poland	European Union						
Commitment period and target year	First commitment period CP1 (2008—2012)	Second commitment period CP2 (2013—2020)	2030	2013—2020		2021—2030		
Emission reduction target	-6%	-20%	Originally: min. -40% Update: min. -55%	Total EU emissions reduction -20% compared to PRIMES Ref. Scenario 2007		Total EU emissions reduction: originally: min. -40%, Update: min. -55%		
				Total EU emissions reduction -21% compared to 2005	Individual target for Poland : increase in emissions no more than 14% compared to 2005	Originally: -43% Update: -62% (target settled at EU level for the whole EU ETS)	Originally: -30% Update: -40% (distributed individually among the MS); individual target for Poland : -17.7% compared to 2005	Originally: the principle of maintaining a positive difference between removals and emissions from LULUCF sector ('no debit' rule) Update: no debit rule in the period 2021-2025 and an overall EU net removals target in 2030 (-310 Mt CO ₂) with an allocation mechanism to national targets during the period 2026—2030
Other commitments	—	—	—	Increasing the use of RES to 20% in final energy consumption and increasing energy efficiency by 20% (EU)		Renewable energy target for the EU by 2030. Originally: at least 32% of final energy consumption, Update: new binding target of at least 42.5%, but aiming for 45%. Energy efficiency target. Originally: at least 32.5% compared to PRIMES Reference Scenario 2007 to be achieved collectively by the EU by 2030, Update: 36—39% to be achieved collectively by the EU by 2030 compared to PRIMES Reference Scenario 2007 – which equates to 11.7% compared to PRIMES Reference Scenario 2020. New reduction target for ETS2 (BRT), covering buildings, road transport and fuels for other sectors, of 43% in 2030 compared to 2005		
Base year	1988 for CO ₂ , CH ₄ , N ₂ O 1995 for HFCs, PFCs, SF ₆	1990 or other selected by the country; 1995 or 2000 for NF ₃ (PL: 1988 for CO ₂ , CH ₄ , N ₂ O; 1995 for HFCs, PFCs, SF ₆ , 2000 for NF ₃)	1990	2005 (1990 for total EU emissions)		2005 (1990 for total EU emissions)		Originally: subject to settlement rules Update: 2021—2025: subject to settlement rules; 2026—2030: average 2016—2018

	International commitments (UNFCCC)			EU law				
	Kyoto Protocol (KP)		Paris Agreement	Energy and climate package 2020		Energy and climate package 2030		
				EU ETS	ESD (non-ETS)	EU ETS	ESR (non-ETS)	LULUCF
	Poland	European Union						
Aviation and shipping	Domestic aviation included; international aviation excluded	Domestic aviation included; international aviation excluded	EU ETS aviation included (practically all aviation included)	Domestic and international aviation included in the EU ETS	Aviation generally excluded; some aviation operations included (below EU ETS threshold)	Included flights from the EU, maritime transport to and from the EU	Excluded	Not applicable
Use of international credits	Use of KP mechanisms in line with KP	Use of KP mechanisms in line with KP	Excluded	Subject to quantitative and qualitative restrictions	Subject to quantitative and qualitative restrictions	Excluded		
Carry-forward of units from previous periods	Not used	According to KP rules including the Doha amendment	Not used	EU ETS allowances may be kept for subsequent EU ETS trading periods from the second trading period onwards	No carry-forward allowed from the previous period	Not used		
Gases covered	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ , NF ₃	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ , NF ₃	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆		CO ₂ , N ₂ O, CF ₄ , C ₂ F ₆	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆	CO ₂ , CH ₄ , N ₂ O
Sectors	As per Annex A of the KP (energy, industrial processes and product use, agriculture, waste), LULUCF as per settlement rules in CP1	As per Annex A of the KP (energy, industrial processes and product use, agriculture, waste), LULUCF as per settlement rules in CP2	Energy, industrial processes and product use, agriculture, waste, LULUCF	Electricity and heat production and industry (e.g., cement, chemical, coke, refinery), aviation (under Annex I to the ETS Directive)	Transport (excluding domestic aviation), municipal and household sector, other industry, agriculture and waste	Electricity and heat production and industry (e.g., cement, chemical, coke, refineries), aviation (according to Annex I to the ETS Directive), after updating the target also maritime transport to and from the EU	Transport (excluding domestic aviation), municipal and household sector, other industry, agriculture and waste	LULUCF
GWP warming factors used	IPCC SAR	IPCC AR4	IPCC AR5	IPCC AR4		IPCC AR5		

Source: study by KOBIZE, IEP-NRI

Under their updated NDC³⁷ the EU and its Member States, acting jointly, are committed to a legally binding target of a domestic reduction of net greenhouse gas emissions by at least 55% compared to 1990 by 2030. The term 'domestic' means without the use of international credits. The NDC consists of a single-year target, and the target type is 'economy-wide absolute emission reduction'. The scope of the NDC covers the 27 EU MS.

³⁷ Submission by Spain and the European Commission on behalf of the European Union and its Member States: the update of the nationally determined contribution of the European Union and its Member States, <https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17%20EU%20submission%20NDC%20update.pdf>

The 17 October 2023 updated NDC scope is supplemented by additional information to clarify the precise amount of international aviation and maritime emissions which are covered under the EU NDC. Details of the EU NDC can be found in the table below and in the Appendix to the Annex II.

Table 19. Description of the NDC of the EU

Information	Description
Target and description	Economy-wide net domestic reduction of at least 55% in greenhouse gas emissions by 2030 compared to 1990. The term 'domestic' means without the use of international credits.
Target type	Economy-wide absolute emission reduction.
Target year	2030 (single-year target)
Base year	1990
Base year value	Net greenhouse gas emissions level in 1990: 4 699 405 kt CO ₂ eq
Implementation period:	2021–2030
Geographical scope	EU Member States (Belgium, Bulgaria, Czechia, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden) including EU outermost regions (Guadeloupe, French Guiana, Martinique, Mayotte, Reunion, Saint Martin (France), Canary Islands (Spain), Azores and Madeira (Portugal)).
Sectors	Sectors as contained in Annex I to decision 5/CMA.3: Energy, Industrial processes and product use, Agriculture, Land Use, Land Use Change and Forestry (LULUCF), Waste. International Aviation: Emissions from civil aviation activities as set out for 2030 in Annex I to the EU ETS Directive are included only in respect of CO ₂ emissions from flights subject to effective carbon pricing through the EU ETS. With respect to the geographical scope of the NDC these comprise emissions in 2024–26 from flights between the EU Member States and departing flights to Norway, Iceland, Switzerland and the United Kingdom. International maritime Navigation: waterborne maritime navigation is included in respect of CO ₂ , methane (CH ₄) and nitrous oxide (N ₂ O) emissions from maritime transport voyages between the EU Member States.
Gases	Carbon dioxide (CO ₂), methane (CH ₄), nitrous oxide (N ₂ O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF ₆), nitrogen trifluoride (NF ₃)
LULUCF categories and pools	The included LULUCF categories and pools are as defined in decision 5/CMA.3.
Intention to use cooperative approaches	The EU's at least 55% net reduction target by 2030 is to be achieved through domestic measures only, without contribution from international credits. The EU will account and report for cooperation with other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA.
Any updates or clarifications of previously reported information, as applicable	The information on the NDC scope contains clarifications/further details compared to the information provided in the updated NDC of the EU.

Source: Updated EU NDC submitted to the UNFCCC, <https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17%20EU%20submission%20NDC%20update.pdf>

Note: This table is identical to table 'Description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates,' which has been submitted electronically together with this BTR1. This table is also annexed to this BTR1 as Appendix to the Annex II.

3. Information necessary to track progress made in implementing and achieving its nationally determined contribution under Article 4 of the Paris Agreement

3.1. Indicators, definitions, methodologies and progress

3.1.1. Indicators, including definitions

For the tracking of progress towards implementing and achieving the NDC of the EU, an indicator is used which has the same unit and metric as the NDC base year and target values. The chosen indicator is 'annual total net GHG emissions consistent with the scope of the NDC in CO₂ eq'. Table 20 provides more information on this indicator.

Table 20. Indicator for tracking progress

Information	Description
Selected indicator	Annual total net GHG emissions consistent with the scope of the NDC in CO ₂ eq
Reference level and base year	The reference level is total net GHG emissions of the EU in the base year (1990). The reference level value for the EU is 4 699 405 kt CO ₂ eq
Updates	This is the first time the reference level is reported, hence there are no updates. The value of the reference level may be updated in the future due to methodological improvements to the EU GHG inventory and to the determination of international aviation and navigation emissions in the NDC scope.
Relation to the NDC	The indicator is defined in the same unit and metric as the target of the NDC. Hence it can be used directly for tracking progress in implementing and achieving the NDC target.
Definitions	Definition of the indicator 'annual total net GHG emissions in CO ₂ eq': Total net GHG emissions correspond to the annual total of emissions and removals reported in CO ₂ equivalents in the latest GHG inventory of the EU. The totals comprise all sectors and gases listed in the table entitled 'Reporting format for the description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates.' Indirect CO ₂ emissions are included from those Member States that report these emissions

Note: Note: The information in this table is identical to the information in Common Tabular Format (CTF) tables 1 ('Description of selected indicators'), which was submitted electronically together with this BTR.

Source: The reference level is based on the Annual European Union GHG inventory 1990-2022.

3.1.2. Methodologies and accounting approach

The EU use the following accounting approach for tracking progress towards the joint EU NDC: annual GHG data from the national GHG inventory of the EU, complemented for international aviation and navigation with estimations from the Joint Research Centre's Integrated Database of the European Energy System.³⁸

The total net GHG emissions are provided in the scope of the EU NDC and are compared to the economy-wide absolute emission reduction target as defined in the NDC. The EU will account for its cooperation with other Parties in a manner consistent with guidance adopted by the CMA.

³⁸ European Commission, Joint Research Centre, Rózsai, M., Jaxa-Rozen, M., Salvucci, R., Sikora, P., Tattini, J. and Neuwahl, F., JRC-IDEES-2021: the Integrated Database of the European Energy System – Data update and technical documentation, Publications Office of the European Union, Luxembourg, 2024

As far as emissions and removals from the LULUCF sector are concerned, net emissions are used for tracking progress towards the 2030 target of the NDC based on all reported emissions and removals.

Details on methodologies and accounting approaches consistent with the accounting guidance³⁹ under the Paris Agreement can be found in CTF Table 3 ('Methodologies and accounting approaches'), which was submitted electronically together with this BTR1. This table also constitutes an attachment to the BTR1.

3.1.3. Structured summary – status of progress

An important purpose of the BTR is to demonstrate where the EU and its Member States stand in implementing their NDC, and which progress they have made towards achieving it. The most recent information on GHG emissions and removals in the scope of the NDC constitutes the key information for tracking this progress. Table 21 summarises the current status of progress.

Table 21. Summary of progress towards implementing and achieving the NDC

	Unit	Base year value	Values in the implementation period			Objective	Target year	Progress made towards the NDC
			2021	2022	2030			
Indicator: Total net GHG emissions consistent with the scope of the EU NDC	kt CO ₂ eq	4 699 405	3 272 650	3 205 223	NA	at least 55% below base year level	2030	The most recent level of the indicator is 31.8 % below the base year level

*NA: Not Applicable.

Source: EC, based on the annual EU greenhouse gas inventory 1990-2022

Note that an annual emissions balance consistent with Chapter III.B (Application of corresponding adjustment) will be provided in a subsequent BTR upon finalisation of relevant further guidance by the CMA, based on the annual information reported under Article 6.2.

Note: More detailed information can be found in CTF Table 4 ('Structured summary: Tracking progress made in implementing and achieving the NDC under Article 4 of the Paris Agreement'), which has been submitted electronically together with this BTR1. The aforementioned table is also attached to the BTR1.

Based on the GHG inventory data and data on international aviation and navigation for 2022, the EU and its Member States reduced net GHG emissions by 31.8 % compared to 1990. The EU and its MS made progress towards implementing and achieving their NDC. The legal and institutional framework is in place to make further progress in the years ahead and to achieve the NDC target by 2030.

³⁹ Decision 4/CMA.1, Further guidance in relation to the mitigation section of decision 1/CP.21, <https://unfccc.int/documents/193407>, str. 6–13.

4. Mitigation policies and measures, actions and plans, including those with mitigation co-benefits resulting from adaptation actions and economic diversification plans, related to implementing and achieving a nationally determined contribution under Article 4 of the Paris Agreement

4.1. Introduction on policies and measures as well as actions related to the reduction of GHG emissions

This Chapter provides information on climate protection policies, measures and actions that support the NDC target set under Article 4 of the Paris Agreement. It focuses on the most relevant measures, i.e., those with the greatest impact on GHG emissions and removals, including the key categories identified in the national emissions inventory.

Poland, as an EU Member State, co-creates the EU climate policy and is obliged to implement EU legislation in this area. Consequently, the majority of climate protection measures implemented by Poland result from EU regulations. Some of them are directly applicable, while others, such as directives, are implemented into the national legal order through national regulations, which are translated into specific measures presented in this report.

Chapter 4.2. presents the most important national policies and measures that have an impact on reducing GHG emissions and fulfilling Poland's emission reduction commitments. Subsequent sections 4.2.1.-4.2.7. present policies and measures by sector, i.e. first the cross-sectoral policies and measures, followed by policies and measures in the energy sector (energy supply and consumption), and then in the transport, industrial processes, agriculture, LULUCF and waste management sectors. Information on these measures, following the required format, is also reported in CTF Table 5.

For policies and measures for which relevant data were available, reduction effects were estimated for 2022 (ex-post effect, achieved) and 2030 (ex-ante effect, planned to be achieved). A description of the methodology used to estimate these effects, and the assumptions made are included in the descriptions of the individual measures in Chapter 4.2, while the data in this respect are given in CTF Table 5.

As detailed information and data on costs, non-GHG benefits and interactions between different measures are not available, this report does not contain information in this respect (requirement according to para 83 of the MPGs Guidelines (Decision 18/CMA.1)). The report also does not contain information under para 84 of the MPGs Guidelines (Decision 18/CMA.1) as it does not apply to Poland.

4.2. Sector-specific policies and measures

4.2.1. Cross-sectoral

Key strategic documents and regulations

The following tables summarise the key national strategic documents and cross-sectoral regulations affecting climate protection and GHG emission reductions. In addition, Table 22 summarises the key sources of climate protection funding in Poland.

Table 22. Key national cross-sectoral strategy documents

Document title	Document description
implemented	
National Air Pollution Control Programme – Update (NAPCP update) adopted by the Council of Ministers on 18 October 2023	NAPCP update implements the requirements of Directive 2016/2284 (the so-called NEC Directive) and updates the first NAPCP developed and submitted to the EC in 2019. NAPCP update presents updated measures and scenarios for Poland's achievement of the emission reduction targets set out in the NEC Directive, i.e. for: sulphur dioxide (SO ₂), nitrogen oxides (NO _x), non-methane volatile organic compounds (NMVOC), ammonia (NH ₃) and fine particulate matter (PM _{2.5}), relating to two periods that cover the years from 2020 to 2029 and from 2030 onwards.
National Urban Policy 2030 (NUP 2030) adopted by the Council of Ministers on 14 June 2022	NUP 2030 replaced the NUP 2023 from 2015. The strategic objective of NUP 2030 is to build conditions to strengthen the capacity of cities and urban functional areas to develop sustainability, improve the residents' quality of life and build resilience to observed climate change. Priority is given to the development of public transport and its integration while introducing restrictions on the environmental nuisance of car transport. In parallel, emphasis is placed on opening up public spaces to promote walking, cycling and micromobility.
State Purchasing Policy for 2022–2025 adopted by the Council of Ministers on 11 January 2022	The State Purchasing Policy is a document that defines the government's most important measures concerning public procurement. Procurement is intended to become a tool to support economic development, including in particular the potential of the small and medium-sized enterprise sector, the growth of innovation and the implementation of social, health and environmental policies. The State Procurement Policy takes the form of a medium-term strategy and is adopted once every four years. It is intended to strengthen the competitiveness of the Polish economy – the implementation of sustainable and innovative procurements (e.g., high-quality food, energy-efficient devices, ecologically produced equipment) is to serve this purpose. The premise of the State Procurement Policy is to link public procurement with the strategic objectives of the state, so that it serves not only to purchase services, supplies or works, but also to implement the economic and social policy of the state.
The National Energy and Climate Plan for the period 2021–2030 (NECP) adopted by the European Affairs Committee on 18 December 2019	The NECP has been developed in accordance with the obligation under the Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action. The NECP presents the objectives and targets as well as policies and measures for the implementation of the 5 dimensions of the energy union, i.e. decarbonisation, energy efficiency, energy security, internal energy market and research, innovation and competitiveness. The NECP assumes the implementation of the EU climate policy targets imposed on Poland (reduction of GHG emissions by 7% from 2005 levels in non-ETS sectors). In addition, it also sets a target for the share of RES in gross final energy consumption of 21–23% in 2030 and a target of improving energy efficiency by 23% by 2030 compared to the PRIMES 2007 forecast. It also addresses the issue of the share of coal in Poland's energy mix and indicates a reduction in its share in electricity production to 56–60% in 2030. The final version of the NECP was submitted to the EC in December 2019.
The 2030 National Environmental Policy adopted by the Council of Ministers on 16 July 2019	The 2030 National Environmental Policy stems from the Strategy for Responsible Development for the period up to 2020 (including the perspective up to 2030) and addresses the environmental dimension (it is one of the development strategies). It aims to ensure Poland's environmental security and a high quality of life for all inhabitants. It reinforces the government's efforts to build an innovative economy with sustainable development principles. The specific objectives have been defined in response to the most important environmental trends, in a way that combines environmental issues with economic and social needs. They relate to health, the economy and the climate. The 2030 National Environmental Policy provides the basis for the investment of European funds from the EU financial perspective 2021–2027. The Strategy also supports the implementation of Poland's objectives and commitments at the international level, including at

Document title	Document description
	the EU and UN levels, particularly in the context of the EU's climate and energy policy objectives until 2030 and the sustainable development goals included in Agenda 2030.
The Strategy for Responsible Development for the period up to 2020 (including the perspective up to 2030) adopted by the Council of Ministers on 14 February 2017	The Strategy is a key document in the area of medium-term economic policy. Its main objective is to create conditions for an increase in the income of the Polish population with a simultaneous increase in cohesion in the social, economic, environmental and territorial dimensions. Its specific objectives include: • Sustainable economic development based increasingly on knowledge, data and organisational excellence (areas: Reindustrialisation, Development of innovative companies, Small and medium-sized enterprises, Capital for development, Foreign expansion), • Socially sensitive and territorially balanced development (areas: Social cohesion, Territorially balanced development), • Effective state and institutions for growth and social and economic inclusion (areas: Law at the service of citizens and the economy, Pro-growth institutions and strategic development management, E-state, Public finances, Efficiency in the use of EU funds) and areas affecting the achievement of the Strategy's objectives: Human and Social Capital, Digitalisation, Transport, Energy, Environment, National Security. The specific objectives set include support for measures to reduce GHG and air pollutant emissions and energy efficiency measures.
planned	
National Energy and Climate Plan until 2030 (update of the 2019 NECP) – draft	Work is currently underway to update the 2019 NECP, the process is based on the requirements of Regulation 2018/1999 and takes into account the latest EU legislation on GHG emission reduction targets, RES development and energy efficiency improvements resulting from the 'Fit for 55' package. The document is currently at the consultation stage.
The National Development Concept 2050 – draft	The National Development Concept 2050 is a visionary document that will guide Poland's development management. The concept is to become a document combining socio-economic and spatial planning. The document will identify the key global and national trends shaping the future in the social, economic, environmental and spatial spheres, indicate a set of the most important development challenges that Poland is facing and will face, formulate possible development scenarios and recommend strategic choices within the framework of public policies in the 2050 perspective. In May 2024, the document received a favourable opinion from the Coordination Committee for Development Policy. The document is currently at the consultation stage.

Source: study by KOBiZE, IEP-NRI

Table 23. Key national cross-sectoral regulations

Document title	Document description
The Act of 12 June 2015 on greenhouse gases emissions trading system (Journal of Laws of 2024, item 1505)	The Act, which is currently in force, transposed the EU Directive 2003/87/EC and the changes introduced by its amendments into national legislation. The Act sets out the principles for the operation of the EU ETS. Work is currently underway to amend this Act to transpose the EU ETS regulations adopted as part of the 'Fit for 55' package.
The Act of 17 July 2009 on the system to manage the emissions of greenhouse gases and other substances (Journal of Laws of 2022, item 673, as amended)	The Act sets out the tasks of the KOBiZE, the rules for the operation of the National System for Emission Balancing and Forecasting, the rules for the management of emissions of GHG and other substances, the rules for the operation of the National Registry System under the Kyoto Protocol, rules for the trading and management of Kyoto units, the rules for the operation of the National Green Investment Scheme and the Climate Account, the conditions and rules for the execution of joint implementation projects within the territory of Poland, the conditions and rules for the execution of joint implementation projects and clean development mechanism projects outside the territory of Poland.
Act of 27 April 2001 – Environmental Protection Law (Journal of Laws of 2021, item 1973, as amended)	The Act sets out the principles of environmental protection and the conditions for the use of its resources, taking into account the requirements of sustainable development, in particular the principles for setting the conditions for the protection of environmental resources, the conditions for the introduction of substances or energy into the environment, the costs of using the environment, as well as the duties of administrative bodies and liability and sanctions.
Act of 20 July 1991 on Environmental Protection Inspection (Journal of Laws of 2021, item 1070)	The Act sets out the state environmental monitoring and the state's rights and obligations to control the state of the environment and enforce environmental legislation in all its elements (e.g., air, water, nature, noise, electromagnetic fields, waste).

Source: study by KOBiZE, IEP-NRI

Table 24. Key sources of funding for climate protection measures

Source of funding	Characteristics
National Fund for Environmental Protection and Water Management (NFEP&WM)	The National Fund for Environmental Protection and Water Management (NFEP&WM) was established in 1989 at the time of Poland's political transformation. It is the main link in the Polish system of financing environmental protection and water management, with the largest financial potential at its disposal. It is an important tool for the implementation of environmental policy in Poland. It offers loans, grants and other forms of co-financing for projects implemented by e.g., local governments, enterprises, public entities, social organisations and individuals. In the public finance sector, the NFEP&WM is also the largest partner of international financial institutions in Poland in handling foreign funds for environmental protection.
European Funds for Infrastructure, Climate, Environment 2021-2027 Programme	The programme has been adopted by the Council of Ministers on 4 January 2022 and approved by the European Commission on 6 October 2022. The European Funds for Infrastructure, Climate, Environment 2021—2027 Programme is a tool for the implementation of EU Cohesion Policy funds. It is a continuation of the Operational Programme Infrastructure and Environment 2014—2020. The main objective of the programme is to improve the conditions for the development of the country through the construction of technical and social infrastructure in line with sustainable development, including through: decarbonising the economy, developing RES and energy infrastructure, transforming towards an environmentally friendly and circular economy, building an efficient and resilient transport system with the lowest possible negative impact on the environment, completing sections of the TEN-T core network by 2030, improving transport safety, ensuring equal access to healthcare and improving the resilience of the healthcare system, and strengthening the role of culture in social and economic development. The programme has a budget of more than EUR 24 billion.
National Recovery and Resilience Plan (NRRP)	The programme consists of 56 investments and 55 reforms. NRRP funding comes from the European Recovery and Resilience Facility (RRF). In June 2022, NRRP was approved by the EC and the EU Council. It will strengthen the Polish economy and make it more able to withstand any crisis. Poland will receive a total of EUR 59.8 billion, including EUR 25.27 billion in grants and EUR 34.54 billion in preferential loans. In April 2024, the first tranche of PLN 27 billion has been received. In line with EU targets, a significant proportion of the budget is allocated to climate objectives (46.6%) and digital transformation (21.36%). The NRRP covers reforms and investments that started after 1 February 2020 and will be completed by 31 August 2026, covering areas such as green energy and energy intensity reduction or green, smart mobility. The REPowerEU chapter added to the NRRP in the revision process, includes seven new reforms and ten investments: six in the grant part with an allocation of EUR 2.76 billion and four in the loan part with an allocation of EUR 22.52 billion. They concern the development of RES and energy networks, the development of sustainable transport and the improvement of energy efficiency.
Modernisation Fund (MF)	The Fund is fed from the monetisation of a 4.5% pool of emission allowances for the 2021—2030 period under the EU ETS. It is an instrument to support the modernisation of the energy system and the improvement of energy efficiency. The Fund is dedicated to 13 EU MS, with Poland accounting for approximately 34% of its funds, which is estimated at around PLN 60 billion (the final amount depends on the EUA price). These funds support a number of NFEP&WM programmes, including those concerning the development of electricity infrastructure for the development of electric vehicle charging stations, building renovation, support for RES and energy efficiency improvements in energy-intensive industries, support for the development of co-generation and the use of alternative fuels for energy purposes.
Just Transition Fund (JTF)	The JTF is a new financial instrument under the EU's Cohesion Policy, providing support to areas facing major socio-economic challenges resulting from the transition in the pursuit of climate neutrality. The Fund will facilitate the implementation of the European Green Deal, which aims to achieve EU climate neutrality by 2050. The JTF provides support to all EU MS based on established criteria including e.g., industrial emissions, coal mining or level of economic development. The level of co-financing of projects is determined by the category of region in which the projects are implemented and ranges from 50-85% depending on the level of development of the region concerned. The total JTF budget for 2021-2027 is EUR 17.5 billion. Poland is expected to receive almost EUR 3.85 billion from the JTF. The Fund is intended to help mitigate the negative social, economic and environmental impacts of the energy transition. The condition for applying for JTF funds is the preparation of territorial plans for a just transition. JTF funds are to go to the following coal regions in Poland: Lower Silesia, Łódź, Małopolska, Wielkopolska and Silesia.
Social Climate Fund (SCF)	The SCF provides support to vulnerable households, micro-enterprises and transport users to enable the introduction of an emissions trading system for the buildings and road transport sectors. To receive support, each EU MS must develop and submit to the EC a specific document (Social Climate Plan) containing a set of measures and investments to address the impact of carbon emission prices on vulnerable citizens. The fund supports energy efficiency improvements

Source of funding	Characteristics
	in buildings, building renovation, de-carbonisation of heating and air conditioning in buildings, and zero- and low-carbon mobility and transport. It has a maximum funding of EUR 59 billion. It has been set up for the period 2027–2032, coinciding with the entry into force of the ETS for the building and road transport sectors.
Norwegian Funds	Non-repayable financial assistance takes the form of two instruments: European Economic Area Financial Mechanism and Norwegian Financial Mechanism. The donors are the three EFTA countries: Norway, Iceland and Liechtenstein. Both mechanisms are governed by uniform rules and procedures and are subject to a single management and implementation system in Poland. The Ministry of Funds and Regional Policy, acting as the National Contact Point (NCP), is responsible for coordinating implementation in Poland. As NCP, the Ministry of Development Funds and Regional Policy is in constant cooperation with the Financial Mechanisms Office in Brussels. Individual programmes of the current (third) edition of the Funds are implemented by Polish public institutions until the end of 2024, with the exception of the Bilateral Cooperation Fund, which will be implemented until 30 April 2025.

Source: study by KOBIZE, IEP-NRI

Policies and measures

Measure 1. GHG Emissions Trading System (EU ETS)

Description

In Poland, as well as in other EU MS, the GHG Emissions Trading System (EU ETS) operates in accordance with the rules set out by the Directive 2003/87/EC⁴⁰ and its subsequent amendments. The most recent amendments were introduced by regulations adopted in 2023 as part of the 'Fit for 55' package, i.e. Directive (EU) 2023/958⁴¹, Directive (EU) 2023/959⁴² and Regulation (EU) 2023/957⁴³. Directive 2003/87/EC was transposed into the national legal order in 2004 by means of the GHG Emissions Trading System Act⁴⁴, which has since been amended several times in response to changes in the EU ETS rules at the level of EU legislation.

The objective of the system is to reduce GHG emissions in the EU in a cost-effective manner, leading to a 62% reduction in GHG emissions from covered installations by 2030 (compared to 2005). The EU ETS covers electricity and heat generation installations, industrial installations and aircraft operators, with only flights within the EU and other European Economic Area countries that have joined the system, i.e. Iceland, Liechtenstein, Norway and Switzerland. Each operator and aircraft operator covered by the system must account for its GHG emissions annually by surrendering the corresponding number of emission allowances (EUAs, EUAAs). From 2024, the system also covers maritime transport (ships over 5,000 tonnes). It is estimated that around 150 ships and 29 shipowners will be covered by the system.

⁴⁰ Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a system for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (OJ L 275, 25.10.2003, as amended).

⁴¹ Directive (EU) 2023/958 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC as regards aviation's contribution to the Union's economy-wide emission reduction target and the appropriate implementation of a global market-based measure (OJ L 130, 16.5.2023).

⁴² Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading system (OJ L 130, 16.5.2023).

⁴³ Regulation (EU) 2023/957 of the European Parliament and of the Council of 10 May 2023 amending Regulation (EU) 2015/757 in order to provide for the inclusion of maritime transport activities in the EU Emissions Trading System and for the monitoring, reporting and verification of emissions of additional greenhouse gases and emissions from additional ship types (OJ L 130, 16.5.2023).

⁴⁴ Journal of Laws of 2024, item 1505.

Emission allowances are sold on the primary market (at auctions on the European Energy Exchange platform – EEX) and on the secondary market (most allowances are sold on the EEX and ICE Futures Europe exchanges). The weighted average EUA price (corresponding to 1 t CO₂ eq) in 2023 was EUR 83.85⁴⁵.

Key historical data on the EU ETS in Poland is presented in the table below.

Table 25. Basic data on the EU ETS in Poland

Year	Number of installations	GHG emissions from installations	Number of aircraft operators	GHG emissions from aviation	Total GHG emissions	Change in CO ₂ eq emissions compared to previous year
	[pcs]	[t CO ₂ eq]	[pcs]	[t CO ₂ eq]	[t CO ₂ eq]	[%]
2008	832	204 107 419	0	0	204 107 419	-2.63
2009	828	191 174 249	0	0	191 174 249	-6.34
2010	810	199 726 907	0	0	199 726 907	4.47
2011	811	203 026 525	0	0	203 026 525	1.65
2012	764	196 636 280	12	641 424	197 277 704	-2.83
2013	783	205 735 395	7	616 587	206 351 982	4.60
2014	767	197 129 387	7	629 899	197 759 286	-4.16
2015	738	198 700 536	6	591 020	199 291 556	0.77
2016	727	198 051 726	5	749 946	198 801 672	-0.25
2017	710	202 166 696	6	943 715	203 110 411	2.17
2018	699	199 974 539	7	1 142 534	201 117 073	-0.98
2019	688	183 690 533	7	1 097 467	184 788 000	-8.12
2020	642	171 729 419	7	421 061	172 150 480	-6.84
2021	601	192 032 908	7	487 570	192 520 478	11.83
2022	577	184 145 848	7	795 207	184 941 055	-3.94
2023	548	153 018 903	6	941 004	153 959 907	-16.75

Source: study by KOBiZE, IEP-NRI

The system currently has a fourth settlement period, covering the period 2021–2030, and the rules governing it have been modified by the 2023 regulations adopted as part of the 'Fit for 55' package.

Key changes compared to previous periods include the following:

- for the purposes of allowance allocation, the 2021–2030 period has been split into two sub-periods: 2021–2025 and 2026–2030, for which an allowance allocation is determined based on a different benchmark value. This is due to the introduction of the principle of adapting benchmarks to technological progress – their values are calculated on the basis of data collected from 5 years in allowance applications and published in the EC Implementing Regulation;
- more flexible rules for allocation of free allowances were introduced, the so-called 'dynamic allocation', to better adjust the level of allocation to actual production levels. Dynamic allocation involves adjusting the allocation of emission allowances in line with increases or decreases in production;
- the total EU-wide allowance pool is reduced by a linear reduction factor (LRF) of 2.2% per year from 2021, then 4.3% from 2024 and 4.4% from 2028. In addition, there will be a twofold step reduction in the number of allowances in the pool: by 90 million allowances in 2024 and by 27 million in 2026;

⁴⁵ Based on data from ICE and EEX exchanges.

- 57% of the emission allowances will be auctioned, the remainder will be allocated for free;
- the allocation of free allowances is reduced by 20% for installations that have not implemented the recommendations resulting from an energy audit or a certified energy management system and for installations with GHG emissions above the 80th percentile in relation to the emission level for the relevant product benchmarks;
- for the aviation sector, free allocation will be withdrawn from 2026 onwards;
- as a result of the introduction of the Carbon Border Adjustment Mechanism (CBAM) on imports from countries not applying adequate climate change measures or applying measures that do not correspond to those in the EU, a phase-out of free allocation was introduced for sectors covered by CBAM, such as cement, aluminium, steel and iron production, fertilisers or hydrogen;
- the MSR (market stability reserve) mechanism has been tightened - the rate on the number of allowances transferred to the MSR has been increased from 12% to 24% after 2023 and rules have been established, effective from 2023, that allowances in the reserve in excess of those provided for the previous year's auctions will lapse;
- all revenues from the auctioning of emission allowances must be earmarked for climate protection and energy transition purposes.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of data for Poland only.

Measure 2. GHG emissions trading system for buildings and road transport sectors (ETS2)

Description

Regulations adopted as part of the 'Fit for 55' package introduced a new separate emissions trading system, the so-called ETS2 (or BRT ETS, Emissions Trading System for Buildings and Road Transport Sectors). ETS2 covers all entities in the Buildings and Road Transport Sectors as well as industrial sectors not covered by the EU ETS. ETS2 concerns emissions from fuels that are allowed for consumption in the above sectors. All municipal and road transport operators that place fuels on the market for combustion for heat, power or mechanical energy production and transport are covered by the system.

The principles of the ETS2 are similar to those of the original EU ETS and are set out in Directive (EU) 2023/959⁴⁶ adopted on 10 May 2023. The system is designed to help EU MS meet the GHG emission reduction targets set out in the ESR (cf. Measure 4) by creating incentives to invest in energy renovation of buildings and low-carbon mobility. To this end, an EU-wide number of emission allowances will be set, which will be reduced in a linear manner by a level of 5.10% from 2024 onwards and, from 2028 onwards, this pool will be reduced by 5.38% each year once the conditions set out in the legislation are met.

Participants in the system will begin monitoring and reporting emissions in 2024, while the system will be fully operational in 2027. In the event of exceptionally high fuel prices in 2026, the start of the system may be postponed to 2028. ETS2 participants will purchase emission allowances at auction, as in the original EU ETS, and will account for their emissions each year by transferring for surrender the number of allowances corresponding to the emissions arising from the fuels allowed to be consumed

⁴⁶ Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading system (OJ L 130, 16.5.2023).

in that year. Across the EU, the ETS2 is assumed to enable a 42% reduction in emissions by 2030 compared to 2005 levels. Part of the proceeds from the ETS2 allowance auctions will feed the Social Climate Fund, the resources of which will be used to support entities most exposed to the additional costs associated with the introduction of the system.

In the first period of the ETS2 operation, fuel combustion for agricultural machinery, fishing boats, trains will be excluded, leaving the agricultural, fishing and rail transport sectors out of the system. In addition, an additional 30% of the planned volume of emission allowances will be auctioned in the first year of the system's operation to help stabilise the price of allowances. On the other hand, if the allowance price exceeds EUR 45 in the first three years of the system operation, additional allowances will be released, increasing the supply on the market (ETS2 market stability reserve).

The Ministry of Climate and Environment is currently preparing the relevant legislation to implement the functioning of the ETS2 system in Poland. It is estimated that several hundred to several thousand entities will be covered by the system in Poland.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of data for Poland only.

Measure 3. Carbon Border Adjustment Mechanism (CBAM)

Description

The CBAM (Carbon Border Adjustment Mechanism) is one of the instruments adopted to implement the EU's 'Fit for 55' package (Regulation (EU) 2023/956⁴⁷). Its purpose is to price GHG emissions emitted during the production processes of goods imported into the EU. The introduction of CBAM is intended to encourage countries outside the EU to use clean technology for industrial production and to level the playing field for the production of goods within and outside the EU, thereby preventing carbon leakage. The implementation of CBAM is divided into a transitional period (starting 1 October 2023 and ending 31 December 2025) and a target period (starting 1 January 2026).

The CBAM mechanism initially applies to imports of specific goods e.g., cement, iron and steel, aluminium, fertilisers, electricity and hydrogen. However, when fully implemented, it is expected to cover more than 50% of emissions in the sectors covered by the EU ETS.

During the transitional period, the CBAM instrument will cover importers or indirect customs representatives (so-called 'declarants subject to reporting') importing goods defined in Annex I of Regulation 2023/956 into the customs territory of the EU or processed products derived from those goods under the inward processing procedure referred to in Article 256 of the Regulation (EU) 952/2013.

During the target period, an importer wishing to introduce goods covered by the CBAM mechanism into the EU, or the indirect customs representative of such an importer, will have to obtain the status of 'authorised CBAM declarant'. They will be required to declare annually the amount of goods imported into the EU in the previous year and the associated embedded GHG emissions, and then account for the aforementioned emissions with the corresponding number of dedicated emission units – CBAM certificates.

⁴⁷ Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 establishing a carbon border adjustment mechanism (OJ L 130, 16.5.2023).

CBAM certificates will have to be purchased in advance by authorised CBAM declarants and held on their account in the CBAM registry. The price for the certificates will be calculated based on the average weekly auction price of EU ETS emission allowances expressed in EUR, and one certificate will be able to account for one tonne of CO₂ emitted. It will be possible to reduce the number of CBAM certificates to be surrendered if a GHG emissions charge has been paid in the country of origin. In addition, on a transitional basis, the number of CBAM certificates to be surrendered will be adjusted (reduced) due to the free allocation of emission allowances under the EU ETS. The phasing out of the free allocation under the EU ETS will take place in parallel with the introduction of CBAM in 2026-2034.

It is estimated that there will be approximately 3,500 importers in Poland covered by CBAM, before the list of goods covered by CBAM will be extended (excluding individuals).

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 4. Reduction of emissions in the non-ETS area

Description

The non-ETS area covers economic sectors outside the scope of the GHG emissions trading system (EU ETS) e.g., transport, agriculture, waste, buildings and industrial sectors not covered by the EU ETS. EU regulations set emission reduction targets in this area for individual MS, initially for 2020 in accordance with Decision 2009/406/EC⁴⁸ (Effort Sharing Decision, ESD). Currently, the ESR (Effort Sharing Regulation) is in force (Regulation (EU) 2018/842⁴⁹), revised in 2023 (Regulation (EU) 2023/857⁵⁰), which aims to ensure that emission reductions in the area of non-ETS in the EU will reach 40% by 2030 compared to 2005 by setting individual MS reduction targets (for Poland -17.7%).

GHG emissions from non-ETS in each MS are reported annually and the reports are subjected to the EU verification process, and then each country accounts for its emissions against its annual emission allocation (AEA). When accounting for emissions in non-ETS, certain flexibility mechanisms as detailed in the revised ESR can be used (banking, borrowing, transferring, flexibility with LULUCF, etc.). Poland has so far used banking of AEA units, i.e. transferring the unused number of AEA units to subsequent years of the accounting period. AEA for the 2021–2025 period for individual MS were set out in EC Implementing Decision 2020/2126 (as amended by Decision 2023/1319 on the basis of the ESR revision). Allocations for the period 2026–2030 will still be set.

EU regulations in the non-ETS area only set national reduction targets and rules for accounting for their achievement. Only the implementation of policies and measures in specific sectors within the non-ETS area will translate into the achievement of the set reduction target. Specific sectoral policies and measures have been discussed in the following sections of Chapter 4.2.

From 2027 onwards, the part of GHG emissions hitherto regulated under non-ETS will also be regulated under the ETS2 (buildings and road transport), as described in Measure 2. Thus, part of the competence

⁴⁸ Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020 (OJ L 140, 5.6.2009, as amended).

⁴⁹ Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013 (OJ L 156, 19.6.2018).

⁵⁰ Regulation (EU) 2023/857 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement, and Regulation (EU) 2018/1999 (OJ L 111, 26.4.2023).

of EU MS to decide on emission reduction measures in the non-ETS area will be shifted to the centralised EU level.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated, as this measure only sets a reduction target (reduction commitment). Reduction effects may result from specific measures taken in individual non-ETS sectors. The available information on reduction effects is therefore given with the relevant measures in the sectors belonging to the non-ETS area.

4.2.2. Energy – energy supply and consumption

Key strategic documents and regulations

The following tables summarise the key national policy documents and regulations for the energy sector (energy supply and consumption), affecting its operation and conditioning environmental and climate protection.

Table 26. Key strategic documents in the energy sector

Document title	Document description
<i>Energy supply</i>	
Polish Hydrogen Strategy until 2030 with an outlook to 2040 adopted by the Council of Ministers on 2 November 2021	The document sets out targets and measures for the development of national competences and technologies for building a low-carbon hydrogen economy. They refer to the three sectors of hydrogen use – energy, transport and industry, as well as to its production, distribution and necessary legal changes and financing. The Strategy identifies objectives and measures for the realisation of the set goals, aimed at using Poland's technological, scientific and research potential in the field of modern hydrogen technologies and at establishing a Polish hydrogen economy branch. The Strategy defines the current state of the hydrogen market, presents basic technological and business barriers, and sets out the directions in which the market should develop to be able to compete with conventional fuels in the next decade.
Energy Policy of Poland until 2040 (EPP2040) adopted by the Council of Ministers on 2 February 2021	EPP2040 is one of the strategies stemming from the Strategy for Responsible Development. It sets out directions for measures to be taken in the 2030 and 2040 timeframes in the energy sector. EPP2040 is based on three pillars and sets out eight specific objectives, the implementation of which will allow for a low-carbon energy transition, with an active role for the end user and the involvement of domestic industry, giving impetus to the economy for further development, while ensuring energy security, in an innovative, socially acceptable manner and with respect for the environment and the climate. The document assumes that in 2040, more than half of the installed capacity will be zero-carbon sources. A special role in this process will be played by the implementation of offshore wind energy into the Polish electricity system and the launch of a nuclear power plant. These will be two new strategic areas and, at the same time, industries to be developed in Poland. Parallel to large-scale power generation, dispersed and civic power generation – based on local capital – will be developed. At the same time, it is planned to increase the use of RES technologies in heat generation and to expand the market for alternative fuels in transport and to end hard coal mining by 2049. At the end of March 2022, the Council of Ministers adopted the assumptions for the update of the EPP2040 energy policy, directed mainly at strengthening energy security and independence, in particular with regard to the rapid decoupling of the domestic economy from imported fossil fuels (coal, oil and natural gas) and derivatives (LPG, diesel, petrol, paraffin) from Russia and other countries subject to economic sanctions. In 2024, the Minister of Climate and Environment announced plans to update the Energy Policy of Poland.
Polish Nuclear Power Programme (PNPP) adopted by the Council of Ministers on 28 January 2014 and updated on 2 October 2020	The PNPP has been adopted in 2014 and is the first comprehensive document relating to nuclear power in Poland. The PNPP defines the scope and organisational structure of activities to be undertaken to implement nuclear power in Poland, to ensure the safe and efficient operation of nuclear power facilities, their decommissioning at the end of their lifetime and to ensure the safe management of spent nuclear fuel and radioactive waste. In 2020, an amendment to the PNPP has been adopted, according to which nuclear power units with a total net capacity of 6-9 GW are planned to be commissioned in Poland. The schedule

Document title	Document description
	adopted in the Programme envisages launching two three-block power plants successively in 2033-2037 and 2039-2043. In 2024, the Ministry of Climate and Environment adopted a resolution to update the PNPP. Work in this area is underway.
<i>Energy consumption</i>	
Long-Term Building Renovation Strategy (LTBRs) adopted by the Council of Ministers on 9 February 2022	The LTBRs presents a comprehensive diagnosis of the situation and the challenge to improve the energy efficiency of the building sector and presents pathways for achieving large-scale and deep renovation of the building stock in Poland by 2030, 2040 and 2050. According to the LTBRs, Polish buildings should be modernised in the long term in a manner consistent with the transformation towards a climate-neutral economy, while addressing the urgent need to replace the most emission-intensive heat sources to improve air quality, while ensuring the economic efficiency of renovation and an equitable distribution of investment costs in building modernisation.
National Housing Programme (NHP) adopted by the Council of Ministers on 27 September 2016	The National Housing Programme (NHP) aims to e.g., ensure the improvement of housing conditions of the population, the technical condition of housing stock and the increase of energy efficiency. In particular, the measures envisage financial support for renovation and thermo-modernisation investments, both from national and EU funds, the implementation of instruments to support revitalisation processes in degraded areas and a review of regulations concerning technical parameters affecting energy efficiency in residential buildings.
National plan for increasing the number of low-energy buildings adopted by the Council of Ministers on 22 June 2015	The plan provides a definition of a low-energy building reflecting existing conditions and achievable and economically reasonable measures to improve the energy performance of buildings. It also identifies government measures to be taken to promote low-energy buildings, including the design, construction and conversion of buildings to make them energy efficient and to increase the acquisition of energy from renewable sources in new and existing buildings.

Source: study by KOBiZE, IEP-NRI

Table 27. Key regulations in the energy sector

Document title	Document description
<i>Energy supply</i>	
Act of 17 December 2020 on promoting electricity generation in offshore wind farms (Journal of Laws of 2024, item 182)	The Act introduces a support system and administrative and legal improvements to enable a more efficient investment process for offshore wind farms.
Act of 14 December 2018 on the promotion of electricity from high-efficiency cogeneration (Journal of Laws of 2024, item 639)	The Act sets out the rules for providing support for electricity generated in high-efficiency cogeneration units and for issuing guarantees of origin for electricity from high-efficiency cogeneration. The Act introduces an auction-based support system for high-efficiency cogeneration. Support is granted for a maximum of 15 years from the date of the auction outcome.
Act of 20 May 2016 on investments in wind power plants (Journal of Laws of 2024, item 317)	The Act sets out conditions and procedures for the location and construction of wind power plants on land and conditions for the location of wind power plants in the vicinity of existing or planned residential development.
Act of 20 February 2015 on renewable energy sources (Journal of Laws of 2023, item 1436, as amended)	The Act defines the terms and conditions for the performance of activities relating to the production of electricity from renewable energy sources, agricultural biogas - in RES installations and bio-liquids. Furthermore, it defines mechanisms and instruments aimed at supporting the production of electricity from renewable energy sources, agricultural biogas and heat in RES installations. It also regulates the rules for issuing guarantees of origin for electricity generated from RES, the rules for the implementation of the National Renewable Energy Action Plan and the conditions and procedure for certifying installers of micro-installations, small installations and RES installations with a total installed thermal power of no more than 600 kW. It defines the principles of international cooperation in the field of RES and joint investment projects. The Act contains a number of solutions designed to create a stable environment for the growth of generation in the renewable energy sector. These include an auction system, transitional solutions from the green certificate system, net-metering for prosumers, and energy clusters.

Document title	Document description
Act of 29 November 2000 on the Atomic Law (Journal of Laws of 2024, item 1277, as amended)	The Act defines the practices of peaceful use of atomic energy related to actual and potential exposure to ionising radiation from artificial radioactive sources, nuclear materials, ionising radiation generating devices, radioactive waste and spent nuclear fuel, the duties of the head of the organisational unit performing these activities, authorities competent in matters of nuclear safety and radiation protection, principles of civil liability for nuclear damage, principles of fulfilment of international obligations, including those under the European Union, concerning nuclear safety, protection against ionising radiation and safeguards of nuclear materials and control of nuclear technology. In addition, it lays down rules for the monitoring of radioactive contamination and regulates measures to be taken in the event of a radiological emergency, as well as in the event of long-term exposure following a radiation event or past activity.
Act of 10 April 1997 – the Energy Law (Journal of Laws of 2024, item 266)	The Act sets out the principles for shaping the state's energy policy, the principles and conditions for the supply and use of fuels and energy, including heat, and the activities of energy enterprises, and defines the authorities competent in matters of fuel and energy management. Its task is to create conditions for sustainable development of the country, ensuring energy security, economical and rational use of fuels and energy, development of competition, counteracting the negative effects of natural monopolies, taking into account environmental protection requirements, obligations arising from international agreements and balancing the interests of energy enterprises and consumers of fuels and energy.
<i>Energy consumption</i>	
Act of 20 May 2016 on energy efficiency (Journal of Laws of 2024, item 1047)	The Act sets out, inter alia, the rules for fulfilling the obligation to achieve energy savings, the rules for carrying out an energy audit of a company and the tasks of public sector entities in the field of energy efficiency. The Act also sets a final energy savings target until 2030 which, in addition to energy efficiency certificates, is implemented by alternative measures from 2021 onwards. To aggregate savings from alternative measures, a central register of final energy savings has been set up, in which data on completed energy efficiency projects will be collected.
Act of 29 August 2014 on the energy performance of buildings (Journal of Laws of 2024, item 101)	The Act sets out the rules for drawing up energy performance certificates for buildings, the rules for inspecting the heating and air-conditioning system in buildings and the rules for keeping a central register of the energy performance of buildings. It also defines how to develop a national action plan to increase the number of buildings with low energy consumption. The Act has streamlined the system for assessing and improving the energy efficiency of buildings, regulated so far under the Construction Law and its implementing acts. According to the changes introduced in 2014, the energy performance of a building has become an integral part of the architectural and construction project, necessary for obtaining a construction permit.
Act of 21 November 2008 on supporting thermo-modernization and renovations and on the central emission register of buildings (Journal of Laws of 2022, item 438, as amended)	The Act sets out the conditions for supporting thermo-modernisation, renovation and RES development projects in multi-family residential buildings with funds from the Thermo-Modernisation and Renovation Fund (TMRF) and the National Recovery and Resilience Plan (NRRP). From 1 July 2021 the Central Emission Register of Buildings was implemented under an amendment to the Act to collect uniform, standardised and consistent data on buildings and premises and the following that are operated in them: heat sources, including district heating supply, electricity sources and fuel combustion. Oversight of Central Emission Register of Buildings is entrusted to the General Office of Building Control.
Regulation of the Minister of Infrastructure of 12 April 2002 on the technical conditions to be met by buildings and their location (Journal of Laws of 2022, item 1225)	The Regulation governs issues related to technical building equipment, energy saving and thermal insulation for buildings being designed, constructed and subject to reconstruction or change of use.

Source: study by KOBIZE, IEP-NRI

Policies and measures

Measure 5. Implementation of large-scale nuclear power generation

Description

Large-scale nuclear power generation is being implemented in Poland based on the Polish Nuclear Power Programme (PNPP) adopted in 2014 and updated in 2020. The programme envisages the

construction of nuclear power plants with a total capacity of 6—9 GW and their successive commissioning from 2033 onwards. By the decision of the Council of Ministers⁵¹, the AP1000 pressurised water reactor (PWR) technology of the American company Westinghouse was indicated.

Methodology for estimating the reduction effect

The reduction effect of this measure was estimated using the planned capacity of the nuclear power plants and the installed capacity factor to estimate electricity production. The GHG emissions that would be emitted if the above-mentioned amount of energy were produced by the current electricity system (with the current fuel mix) were then calculated. For this purpose, the emission factor of electricity production in Poland was used. The resulting emission value represents the reduction effect in the form of avoided emissions. Zero value of the reduction effect presented in the report (CTF Table 5) results from the schedule of operation. Commissioning of the first nuclear unit is planned after 2030.

Measure 6. Preferences for electricity generators in high-efficiency cogeneration

Description

Polish regulations provide for preferential treatment for generators of electricity from high-efficiency cogeneration, including in terms of priority in the provision of services for the transmission or distribution of electricity generated from high-efficiency cogeneration and the off-take of electricity generated from high-efficiency cogeneration. In addition, an obligation has been introduced to connect to an existing district heating network or to equip with an individual renewable heat source, a cogeneration heat source or a waste heat source new facilities located in an area where technical conditions for the supply of heat from an energy-efficient district heating or cooling system exist, which are not connected to a district heating network or equipped with an individual heat source and where the expected peak thermal power of the facilities and equipment for heating the facility is not less than 50 kW.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 7. Cogeneration bonus

Description

The support system for high-efficiency cogeneration, introduced from 2019, includes a system of subsidies for the electricity produced in high-efficiency cogeneration – allocated on different principles depending e.g., on the size and type of the high-efficiency cogeneration installation. Support is available in the form of a cogeneration bonus for new and substantially modernised cogeneration units with an installed electrical capacity of 1—50 MW and a guaranteed bonus for existing and modernised cogeneration units with an installed electrical capacity of 1—50 MW, and new, substantially modernised, existing or modernised small cogeneration units (with an installed electrical capacity of less than 1 MW). It is also possible to obtain an individual cogeneration bonus for new and substantially modernised cogeneration units with an installed electrical capacity of not less than 50 MW and a guaranteed individual bonus for existing and modernised cogeneration units with an installed electrical capacity of not less than 50 MW.

⁵¹ Resolution No. 215/2022 of the Council of Ministers, 2.11.2022 (Polish Official Gazette 'Monitor Polski' 2022, item 1124).

Methodology for estimating the reduction effect

The reduction effect of this measure was estimated using data on electricity production in high-efficiency cogeneration in particular years and the emission factor of electricity production in Poland in 2022. The volume of energy production comes from data made available by Zarządca Rozliczeń S.A. company supervising the mechanism (historical data) and from the Regulatory Impact Assessment for the Act introducing the mechanism (forecast data for future years).

Measure 8. Renewable Energy Certificates System (Green Certificate System)***Description***

In 2005, a support system for RES was introduced through formal certificates of origin for RES energy and property rights as a trading document. An obligation to register all transactions with green certificates on the Polish Power Exchange (TGE) in Warsaw has been introduced. Currently, only existing RES installations are covered by the system, and it will remain in force until 31 December 2035 at the latest. New installations can, in principle, participate in the auction system from 2016. Existing installations can voluntarily switch from the green certificate system to the auction system.

Methodology for estimating the reduction effect

The reduction effect of this measure has been estimated for historical years only (ex-post effect). The calculations were based on the production of electricity from RES between 2005 and 2022 confirmed by the certificates of origin issued (ERO data) and the emission factor of electricity production in Poland in 2022. No data are available to estimate the ex-ante reduction effect.

Measure 9. Auction-based RES support system***Description***

The auction-based support model has been introduced by the Renewable Energy Act in 2015 and replaced the support regime based on the certificate of origin system. The system involves the government procuring a certain amount of renewable energy, which is determined by a decree of the Council of Ministers, and its generators enter an auction. The auction is won by the participants who offer the lowest price for the sale of electricity, until the amount or value of electricity to be sold in the auction is exhausted. The maximum price in the auction is also determined by a decree of the minister in charge of energy, which sets reference prices for individual RES technologies. The period of support is 15 years, starting from the date of the first sale of electricity after the date the RES generator wins the respective auction. The financing of generators and the support system dedicated to the RES sector is made possible by the RES fee. The RES fee is a variable fee depending on the consumption of electricity by a given end-user, which ensures that the fee is fair and proportionate. It is paid by all electricity consumers.

Methodology for estimating the reduction effect

The reduction effect of this measure was estimated using electricity production in individual years and the emission factor of electricity production in Poland in 2022. Energy production was determined based on data on the amount of energy covered by the RES auction support system obtained from Zarządca Rozliczeń S.A. (historical data) company. Forecast data on electricity production were obtained from the Regulatory Impact Assessment document for the Act introducing the system.

Measure 10. Feed-in tariffs and feed-in premium system***Description***

The support system in the form of feed-in tariffs (FIT) and feed-in premium (FIP) is sanctioned by the RES Act. It is aimed at RES generators with the smallest capacity and serves to manage unused energy by a small generator with a capacity of less than 1 MW. The FIT scheme can be used by RES electricity generators in installations with an installed capacity of less than 500 kW selling unused electricity to a designated energy trading company. The FIP scheme, on the other hand, is for RES-E generators with a total installed electrical capacity of 1 MW or less, who sell or will sell unused electricity, to an entity of their choice.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 11. Obligation to purchase electricity generated by RES installations with a total installed capacity of less than 500 kW***Description***

As of 1 January 2018, the purchase obligation has been limited to electricity generated in RES installations with a total installed capacity of less than 500 kW. Sellers are obliged to purchase all electricity generated in these installations at a price equivalent to the average price of electricity sales on a competitive market in the previous quarter, as announced by the President of the ERO pursuant to Article 23(2)(18a) of the Act – Energy Law.

Methodology for estimating the reduction effect

The reduction effect of this measure has been estimated for historical years (ex-post effect). The estimation was based on information on the amount of electricity generated from renewable energy sources in a small installation provided by the ERO and the emission factor of electricity production in Poland in 2022. No data are available to estimate the ex-ante reduction effect.

Measure 12. Reduction of methane emissions from fuel production and distribution processes***Description***

The reduction of methane emissions from fuel production and distribution processes results from the provisions of the Regulation of the Minister of Economy of 21 November 2005 on the technical conditions to be met by liquid fuel depots and stations, long-distance transfer pipelines for the transport of crude oil and petroleum products and their location. This measure introduced stricter technical requirements for the operation of storage systems. The regulation imposed limits on the level of annual losses of petroleum products in storage, filling and emptying processes. The set value for the maximum level of releases is 0.01% of their capacity.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 13. Support for off-shore wind farms development***Description***

The support system for offshore wind farms (OWFs) located on the Baltic Sea has been established in a dedicated Act of 2020 and consists of covering the negative balance⁵². The generator can exercise this right for a period of 25 years, calculated from the first generation of electricity in the OWF and its integration into the grid on the basis of the electricity generation licence obtained. The right to cover the negative balance is granted for an amount of electricity not exceeding the product of 100,000 hours and the OWF's installed electrical capacity or part thereof resulting from the generation concession (but not higher than the capacity indicated in the decision granting support, or the bid submitted in the auction).

The right to cover a negative balance can be obtained in two ways. Firstly, this right may be granted by an individual decision issued by the President of the Energy Regulatory Office. The total OWF capacity for which the President of the ERO may issue a decision granting support cannot exceed 5.9 GW. By June 2021, the entire pool has been used. In the case of support under an individual decision of the President of the ERO, the basis for the settlement of the negative balance will be the price specified in the regulation of the minister in charge of energy.

Secondly, the right to cover the negative balance can be obtained through auctions conducted by the President of the ERO. The maximum price that may be indicated in the bids submitted by generators will be determined by a decree of the minister in charge of energy. The auctions are to take place, in principle, in 2025 and 2027. According to the Act, the maximum OWF capacity for which support may be granted in individual auctions shall be equal to 2.5 GW in each auction. The government has the right to order further auctions in subsequent years.

Methodology for estimating the reduction effect

The reduction effect of this measure (ex-ante) has been estimated using the assumed electricity production of offshore wind farms given in the Regulatory Impact Assessment for the OWF Act and the emission factor of electricity production in Poland in 2022. The ex-post effects are zero as OWF have not yet been commissioned.

Measure 14. 'My Electricity' Priority Programme***Description***

'My Electricity' Priority Programme, coordinated by the NFEP&WM, is the implementation of the Strategy for Responsible Development. The programme aims to increase the production of electricity from photovoltaic micro-installations in Poland. It is an instrument dedicated to support the development of prosumer energy, specifically the photovoltaic micro-installation segment. It assumes co-financing of the purchase by individuals and installation of a photovoltaic installation with a capacity between 2 and 10 kW, serving the needs of existing residential buildings. Subsidies can be obtained when the installation is already made and connected to the electricity grid (e.g., the requirement for a two-way meter).

⁵² The right to cover the negative balance means, in practice, the right to cover the difference between the market price of energy and the price enabling generators to cover the costs of offshore generation.

The programme has been modified several times. It now includes not only domestic PV micro-installations, but also energy and heat storage facilities that increase the self-consumption of electricity generated from own (private) PV panels.

Methodology for estimating the reduction effect

The methodology for calculating the reduction effect (ex-post and ex-ante) of GHG emissions is based on the product of the installed capacity of PV micro-installations and the emission factor of electricity production in Poland.

Measure 15. 'Energy Plus' Priority Programme

Description

The aim of the programme is to reduce the negative impact of businesses on the environment, including improving air quality, by supporting investment projects. Eligible for support are projects aimed at reducing the consumption of primary energy sources, reducing or avoiding harmful emissions into the atmosphere, building new sources of heat and electricity, modernising/expanding district heating networks and making energy use of geothermal resources.

Methodology for estimating the reduction effect

The methodology for estimating the ex-ante reduction effect for GHG emissions depends on the beneficiary of the Programme. For energy generation units, the reduction effect is the reduction of CO₂ emissions calculated based on the amount of energy produced from RES installations replacing electricity from the National Power System (NPS), i.e. taking into account the emission factor of electricity production in Poland. For energy efficiency projects, the reduction effect is a decrease in CO₂ emissions calculated using the amount of energy saved. The amount of energy saved results from the conducted energy audit. No data are available to estimate the ex-post reduction effect.

Measure 16. 'Polish Geothermal Plus' Priority Programme

Description

The aim of the programme is to increase the use of geothermal resources in Poland. Accordingly, local projects are supported in places where the right conditions for geothermal development exist. Support is available for ventures involving the construction of a new, expansion or modernisation of an existing geothermal heat/thermal power plant/electricity plant based on a geothermal source, the modernisation or expansion of existing energy generation sources to include a geothermal heat/thermal power plant/electricity plant based on a geothermal source, and the drilling or reconstruction of a geothermal borehole, excluding the drilling of the first exploratory borehole.

Methodology for estimating the reduction effect

The ex-ante reduction effect on GHG emissions has been estimated using the balance of thermal energy procured on an annual average basis by consumers. The projected heat energy stream that the theoretically implemented geothermal project will deliver is determined. The avoided CO₂ emissions are determined as the product of the aforementioned geothermal heat production and the emission factor of the historically produced heat, or alternatively another current heat emission factor. No data are available to estimate the ex-post reduction effect.

Measure 17. 'District heating' Priority Programme***Description***

The aim of the programme is to reduce the negative impact of district heating companies on the environment, especially those operating locally, including improving air quality, by supporting investment projects leading to a reduction in the consumption of primary raw materials, replacing them with secondary raw materials or waste. Support is also provided for projects leading to a reduction in harmful emissions into the atmosphere and improving air quality by lowering the volume of emissions into the atmosphere from industrial activities (not directly related to fuel combustion sources), as well as projects implemented in an existing enterprise/plant concerning the construction or reconstruction of generating units together with their connection to the distribution/transmission network, in which energy from renewable sources, waste heat and heat from cogeneration is used for energy production. The modernisation and expansion of the district heating network and the energetic use of geothermal resources are also co-financed.

Methodology for estimating the reduction effect

The methodology for estimating the reduction effect (ex-post and ex-ante) on GHG emissions is based on estimating the avoided CO₂ emissions, which is the product of the amount of heat produced from the contractually supported technology and the difference in CO₂ emissions between the old and new technology used, or alternatively another current heat benchmark.

Measure 18. 'Agroenergy' Programme***Description***

This programme aims to provide comprehensive support related to reducing the negative environmental impact of agricultural measures. Support is provided for projects involving the purchase and installation of photovoltaic installations, wind installations, heat pumps and a hybrid installation with specific parameters. In May 2021, the programme has been updated. The scope of support has been extended to include agricultural biogas plants and small hydropower plants. It is also possible to subsidise accompanying energy storage facilities.

Methodology for estimating the reduction effect

The methodology for estimating the GHG reduction effect is to estimate the reduction in CO₂ emissions (avoided emissions) calculated using the amount of energy produced (ex-post effect) or planned to be produced (ex-ante effect) from the RES installation that replaces the energy (electricity or electricity and heat) from the replaced source, taking into account the emission factors of the replaced fuel.

Measure 19. 'New Energy' Programme***Description***

The aim of the programme is to reduce the negative impact of businesses on the environment, including improving air quality, by supporting investment projects. Eligible for support are projects aimed at reducing the consumption of primary energy sources, reducing or avoiding harmful emissions into the atmosphere, building new sources of heat and electricity, modernising/expanding district heating networks and making energy use of geothermal resources.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 20. 'My Heat' Priority Programme***Description***

This programme aims to support the development of individual heating and prosumer energy in the area of air, water and ground source heat pumps in new single-family residential buildings. It co-finances investments consisting in the purchase and installation of new heat pumps (air and ground source) for heating purposes or for heating and domestic hot water in new single-family residential buildings.

Methodology for estimating the reduction effect

The methodology for estimating the ex-post and ex-ante GHG reduction effect is to estimate the reduction in CO₂ emissions (avoided emissions) based on the number of heat pumps and their output, compared to the baseline option, i.e. gas boiler with solar panels.

Measure 21. 'My Wind Power Plant' Priority Programme***Description***

The aim of the programme is to develop prosumer energy in the area of micro wind power plants. Support for the purchase and installation of a household wind power plant or the purchase and installation of a household wind power plant together with an electricity storage facility will contribute to an increase in the share of RES in final energy consumption, will allow for an increase in self-consumption of generated electricity through its storage (electricity storage facilities), and will contribute to the promotion of renewable energy sources. Support is provided for investments in the purchase and installation of wind micro-installations for residential buildings, used to meet the Applicant's own energy needs – a wind turbine with an installed electrical power of not less than 1 kW and not more than 20 kW, together with the accessories necessary for the proper operation of the micro-installation, including the purchase and installation of accompanying energy storage facilities with a capacity of at least 2 kWh.

Methodology for estimating the reduction effect

The methodology for estimating the ex-post GHG reduction effect is to estimate the reduction in CO₂ emissions (avoided emissions) based on the number of wind power plants planned to be supported, the planned capacity of the installation, the averaged operation time of the installation and the emission factor of electricity production in Poland. No data are available to estimate the ex-ante reduction effect as the programme has been launched in 2024.

Measure 22. 'Energy for Rural Areas' Priority Programme***Description***

The aim of the programme is to increase the use of renewable energy sources in rural and rural-urban municipalities. Funding is available for investments implemented by an energy cooperative or its member, or by an emerging energy cooperative, and farmers in the construction of photovoltaic installations, wind turbines, biogas plants and hydroelectric power plants.

Methodology for estimating the reduction effect

The methodology for estimating the ex-post reduction effect for GHG emissions is to estimate emission reductions using the amount of energy assumed to be produced from the RES installation that replaces the energy (electricity or electricity and heat) from the source being replaced, taking into account the

emission factors of the fuel being replaced. No data are available to estimate the ex-post reduction effect.

Measure 23. 'District Cogeneration' Priority Programme

Description

The aim of the programme is to propose the use of high-efficiency cogeneration in the district heating sector. Support is provided for investments concerning the construction and/or reconstruction of generating units with a total installed capacity of not less than 1 MW, operating under high-efficiency cogeneration conditions (excluding energy generated in a coal-fired cogeneration unit) together with their connection to the grid, where waste heat, energy from RES or gaseous fuels, gas mixtures, synthetic gas or hydrogen is used for energy production.

Methodology for estimating the reduction effect

The methodology for estimating the ex-ante reduction effect of GHG emissions is based on the product of the projected heat production from the new installation and the heat and electricity emission factor. No data are available to estimate the ex-post reduction effect.

Measure 24. 'Energy-intensive industry – RES' Priority Programme

Description

The aim of the programme is to reduce the carbon emissions of energy-intensive industries in Poland by increasing electricity generation from renewable energy sources. Co-financing is available for investments in the construction or reconstruction of electricity generation units from renewable energy sources, together with energy storage or their connection to the plant and/or distribution/transmission network.

Methodology for estimating the reduction effect

The methodology for estimating the ex-ante reduction effect for GHG emissions is based on the estimation of CO₂ emission reductions (avoided emissions) calculated using the amount of energy planned to be produced from RES installations that replace NPS electricity, taking into account the emission factor of electricity production in Poland. No data are available to estimate the ex-post reduction effect.

Measure 25. 'Hydrogenisation of the economy' Programme

Description

The aim of the programme is to develop a low-carbon and zero-carbon economy by supporting projects involving the implementation of hydrogen technologies along with technical infrastructure for hydrogen production, storage, transport and use. Support is given to projects involving systems for the production, storage, transport of low-emission, including renewable hydrogen with the use of transmission and distribution networks, and its subsequent use as a final product (transport, industry, district heating and power generation in electricity generation systems) and as a substrate in industrial processes, including as part of hydrogen energy storage facilities, for the production of synthetic fuels and energy carriers.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 26. 'Cogeneration for Energy and Industry' Priority Programme***Description***

The aim of the programme is to promote the use of high-efficiency cogeneration for industry. The programme covers investments concerning the construction and/or reconstruction of generating units with a total installed capacity of no less than 10 MW operating under high-efficiency cogeneration conditions (excluding energy generated in a coal-fired cogeneration unit), together with their connection to the transmission network, where waste heat, energy from renewable sources or gaseous fuels, gas mixtures, synthetic gas or hydrogen is used for energy production. Support is also provided for investments concerning the construction and/or reconstruction of generating units with a total installed capacity of no less than 0.5 MW operating in high-efficiency cogeneration conditions (excluding energy generated in a coal-fired cogeneration unit) together with their connection to the transmission network, where waste heat, energy from renewable sources or gaseous fuels, gas mixtures, synthetic gas or hydrogen is used for energy production.

Methodology for estimating the reduction effect

The methodology for estimating the ex-ante reduction effect for GHG emissions is to estimate emission reductions (avoided emissions) using the amount of planned energy savings, taking into account the regulation on how to calculate the data provided for the use of the support scheme and the detailed scope of the obligation to confirm data on the amount of electricity from high-efficiency cogeneration. No data are available to estimate the ex-post reduction effect.

Measure 27. 'Digitisation of district heating networks' Priority Programme***Description***

The aim of the programme is to digitise the district heating network to optimise it. The Programme supports projects for the construction and/or reconstruction of automation, telemetry and telemechanics systems consisting in the implementation of modern IT/OT tools and solutions for, inter alia, supervision, control, monitoring and analysis of qualitative and quantitative parameters of the operation of the district heating system and heat/cooling transmission, as well as fault location; RES installations generating energy exclusively for the needs of equipment connected to the telemetry and telemechanics system, where an energy store may be an element of the RES installation, provided it is integrated with the RES source; projects using waste heat from the control room operating for the purposes of district heating network management. Co-financing is possible provided that the installation will operate under conditions of high-efficiency cogeneration.

Methodology for estimating the reduction effect

The methodology for estimating the ex-ante reduction effect for GHG emissions is to estimate the emissions avoided by converting the projected thermal energy savings achieved by the digitisation project, as determined by the audit, by the historical heat emissivity index or alternatively another current heat emissivity index. No data are available to estimate the ex-post reduction effect.

Measure 28. 'Cogeneration for Heat' Priority Programme***Description***

The aim of the programme is to propose the use of high-efficiency cogeneration in the district heating sector. Co-financing is available for investments concerning the construction and/or reconstruction of generating units with a total installed capacity of no less than 10 MW operating under high-efficiency

cogeneration conditions (excluding energy generated in a coal-fired cogeneration unit), together with their connection to the transmission network, where waste heat, energy from renewable sources or gaseous fuels, gas mixtures, synthetic gas or hydrogen is used for energy production.

Methodology for estimating the reduction effect

The methodology for estimating the ex-ante reduction effect of GHG emissions is based on an estimate of avoided emissions using the product of the projected heat production from the new installation and the heat and electricity emission factor in Poland. No data are available to estimate the ex-post reduction effect.

Measure 29. 'RES – heat source for district heating' Priority Programme

Description

The aim of the programme is to support investments in the generation of thermal energy from renewable sources. Co-financing is provided for investments concerning the construction and/or reconstruction of sources with a total installed capacity of at least 2 MWt (the minimum capacity of built/expanded RES sources must not be less than 2 MWt), where energy from renewable sources limited to heat pumps, solar collectors, geothermal energy is used to produce thermal energy.

Methodology for estimating the reduction effect

The methodology for estimating the ex-ante GHG reduction effect is based on the estimation of the GHG reduction effect as avoided CO₂ emissions, which is the product of the heat production to be replaced by RES and the emission factor of the historically (pre-investment) produced heat, or alternatively another current heat emission factor. No data are available to estimate the ex-post reduction effect.

Measure 30. Other programmes supporting development of RES and cogeneration

Description

The measure covers the co-financing of projects aimed at the construction or modernisation of district heating and electricity systems to enable the connection of RES, and the construction or modernisation of RES units and units producing heat and electricity in high-efficiency cogeneration. The measure includes programmes under OPI&E 2014-2020 for low-carbon and resource-efficient economy projects involving generation and distribution of energy from renewable sources, connection of RES sources to the distribution/transmission network, and high-efficiency cogeneration of heat and electricity and distribution of heat and cooling. The measure mainly covers the programmes outlined below. Analogous support for RES and cogeneration development is planned under the European Funds for Infrastructure, Climate, Environment 2021-2027 Programme.

Table 28. Other key programmes supporting development of RES and cogeneration

Name of Programme	Description
Operational Programme Infrastructure and Environment 2014–2020 Measure 1.1. Supporting the generation and distribution of energy from renewable sources.	The aim of the measure is to support the implementation of investment projects concerning the construction or reconstruction of generation units resulting in an increase in energy generation from RES, together with the connection of these sources to the distribution/transmission network. The project component is the connection to the electricity grid or district heating network belonging to the project beneficiary (energy producer). Support includes the construction or reconstruction of energy generation units using wind energy (above 5 MWe), biomass (above 5 MWt/MWe), biogas (above 1 MWe), water (above 5 MWe), solar energy (above 2 MWe/MWt) and geothermal energy (above 2 MWt).

Name of Programme	Description
Sub-measure 1.1.1. Supporting investment in the generation of energy from renewable sources with the connection of these sources to the distribution/transmission network	
Operational Programme Infrastructure and Environment 2014—2020 Measure 1.1. Supporting the generation and distribution of energy from renewable sources Sub-measure 1.1.2 Supporting projects concerning the construction and reconstruction of networks enabling the connection of RES energy generation units	The aim of the measure is to support projects concerning the construction or reconstruction of the electricity network resulting in an increase in the capacity of the electricity infrastructure allowing new generation capacity from renewable energy sources to be connected to the electricity network of the Transmission System Operator (TSO) or the 110 kV networks of the Distribution System Operators (DSOs).
Operational Programme Infrastructure and Environment 2014—2020 Measure 1.5. Efficient distribution of heating and cooling and Sub-measure 1.7.2. Efficient distribution of heating and cooling in the Śląskie Voivodship	The aim of the measure is to improve air quality by reducing emissions of pollutants that are particularly harmful to people's quality of life, i.e. reducing so-called 'near-ground emissions' in areas with above-normative levels of PM10 concentrations. The investments are expected to contribute to a reduction in the consumption of non-renewable primary energy, a reduction in CO ₂ emissions and a reduction in the emission of dust into the atmosphere. This measure supports the improvement of the efficiency of heat transmission and distribution to existing consumers, in particular through the modernisation and reconstruction of district heating networks and the elimination of collective and individual sources of near-ground emissions, including in residential buildings by connecting them to efficient district heating and cooling systems.
Operational Programme Infrastructure and Environment 2014—2020 Measure 1.6. Promotion of the use of high-efficiency cogeneration of heat and power based on useful heat demand and Sub-measure 1.7.3. Promotion of the use of high-efficiency cogeneration of heat and power in the Śląskie Voivodship	The aim of the measure is to achieve savings in primary energy consumption. Support includes the construction of new or an increase in the capacity (as a result of expansion or reconstruction) of existing electricity and heat generation units using high-efficiency cogeneration technology in CHP units. Preference will be given to projects with the greatest potential for reducing CO ₂ emissions per unit of funding, which also enable the greatest reduction of dust emissions into the air.

Source: study by KOBiZE, IEP-NRI, based on information from NFEF&WM

Measure 31. Implementation of SMR-based nuclear power plants

Description

The aim of the measure is to provide conditions for the commissioning and operation of the small modular reactors (SMRs) by private entities, including, inter alia: human resources and competence development, building public awareness and strengthening the potential of Polish industry.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 32. White certificates scheme***Description***

The white certificate scheme, obliging energy efficiency improvements, was introduced through the statutory imposition, as of 1 January 2013, of an obligation on obliged entities. Currently, the scheme operates under the Act of 20 May 2016 on energy efficiency and also implements the provisions of Directive 2012/27/EU⁵³ on energy efficiency and its amendment, Directive 2023/1791⁵⁴.

The white certificates scheme, introduced under the above-mentioned Act, is a basic support mechanism for measures aimed at improving the energy efficiency of the economy, increasing energy savings by end users, reducing losses of electricity, heat, natural gas or liquid fuels in transmission or distribution. The system covers energy companies. The main task of the white certificates scheme is to bring about the fulfilment of the energy efficiency target. As of 2021, a second energy savings period is in force, covering the years 2021-2030. White certificates have property rights and are traded on the Polish Power Exchange.

Methodology for estimating the reduction effect

The reduction effect of this measure was estimated using data on final energy savings achieved (ex-post effect) and final energy savings under the white certificates scheme, planned to be achieved according to the Act on Energy Efficiency (ex-ante effect). The calculation used the CO₂ emission factor for electricity end-users in Poland in 2022.

Measure 33. Development of energy audits and energy management systems***Description***

The Act on Energy Efficiency 2016 made it compulsory for large businesses to carry out energy audits every four years. The introduction of this obligation also implements the provisions of the Directive 2012/27/EU and its amendment, i.e. Directive 2023/1791.

The energy audit of a company is mandatory and concerns energy consumption in all its forms but is not linked to the white certificate system. Its purpose is to identify potential energy savings, carrying out detailed and validated calculations of proposed energy efficiency measures. The audit should provide a detailed overview of the energy consumption, accounting for at least 90% of the total energy consumption, related to the actions provided by the enterprise in question.

Methodology for estimating the reduction effect

The reduction effect (ex-post effect) of this measure has been estimated using data on achieved final energy savings, resulting from conducted audits, using the CO₂ emission factor for end-users of electricity in Poland in 2022. The ex-ante effect was not estimated due to the lack of the necessary data.

⁵³ Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC (OJ L 315, 14.11.2012).

⁵⁴ Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (OJ L 231, 20.9.2023).

Measure 34. 'Clean Air' Priority Programme***Description***

The programme includes funding for the comprehensive thermo-modernisation of buildings and the replacement of old and inefficient solid fuel heat sources with modern heat sources that meet the highest standards. Its aim is to improve energy efficiency and reduce emissions of dust and other pollutants into the atmosphere from existing single-family residential buildings or from newly constructed single-family residential buildings.

Financial support is provided by the NFEP&WM and covers the replacement of solid fuel cookers, thermo-modernisation of residential buildings, including the costs of preparing sector-specific design documentation (modernisation of internal installations and replacement of the heat source, reconstruction of the roof for insulation) and the costs of purchasing equipment, installations, building materials as part of the building's thermo-modernisation.

As of September 2018, i.e. since the launch of the programme, it has been modified several times. A number of changes have been introduced, the most important being the simplification of the subsidy rules, the reduction of the application processing time from 90 to 30 days, the simplification of the subsidy application, the introduction of the possibility to apply online, the integration with the 'My Electricity' programme, the 'Stop Smog' programme and the thermo-modernisation relief, the linking of the subsidy level to the environmental effect – rewarding zero-emission investments, the inclusion of banks to lead the credit path within the programme.

The programme has secured stable funding from the European Funds for Infrastructure, Climate, Environment 2021-2027 Programme, NRRP and NFEP&WM resources.

Methodology for estimating the reduction effect

The reduction effect of this measure has been estimated using information on the energy savings achieved (ex-post effect) and planned to be achieved (ex-ante effect) (i.e. unit final energy demand before and after the implementation of the works) as a result of the implementation of the programme. The methodology also took into account the CO₂ emission factor for electricity end-users in Poland in 2022.

Measure 35. Thermal Modernisation and Renovation Fund***Description***

The Thermal Modernisation and Renovation Fund (TMRF) covers comprehensive financial assistance for the thermal modernisation of residential buildings. Support is provided e.g., in form of a thermo-modernisation bonus, renovation bonus, Municipal Housing Allowance and compensation bonus.

From the TMRF resources, located in the Bank Gospodarstwa Krajowego, the TERMO programme is financed. From 1 February 2023, this programme is also financed from funds planned under the National Recovery and Resilience Plan (NRRP).

The TERMO programme supports the following projects:

- 1) thermo-modernisation – improving the technical condition of existing residential buildings and significantly influencing the reduction of energy consumption in buildings for hot water heating, reduction of primary energy losses or change of energy sources to more efficient and ecological ones,

- 2) renovations – improving the technical condition of residential buildings in a way that leads to energy savings,
- 3) related to the installation of renewable sources in multi-family buildings.

The beneficiaries of the programme are owners or managers of multi-family buildings, including primarily housing communities and cooperatives, municipalities and other entities.

A measure funded under TMRF is also the 'Stop Smog' Programme. This is a programme aimed at supporting owners of single-family residential buildings, aiming not only to improve energy efficiency, but mainly to reduce air pollutant emissions from heating systems. The programme is addressed to all municipalities that can demonstrate poor air quality in their area, i.e. concentrations of air pollutants exceed EU standards. It covers the implementation in the above households of undertakings consisting of in e.g., replacement of equipment or heating systems to meet low-emission standards, connection to a district heating, electricity or gas network, comprehensive thermo-modernisation of the building. The projects are implemented for the final beneficiary by the municipality and financed from public funds up to 100% of their value. The municipality provides 30% of its own contribution (in the case of municipalities with more than 100,000 inhabitants, the contribution must be higher). The remaining part of the Programme (70%) is financed from the state budget, through the TMRF.

Methodology for estimating the reduction effect

The reduction effect of this measure has been estimated using data collected in the Central Register of Final Energy Savings concerning final energy savings achieved (ex-post effect) and planned to be achieved (ex-ante effect), using the CO₂ emission factor for electricity end-users in Poland in 2022.

Measure 36. Tax relief on expenditure incurred for thermal modernisation of single-family dwellings

Description

The tax relief consists of the possibility of deducting from the tax calculation basis (income – in the case of a flat tax) the expenses incurred for the implementation of a thermo-modernisation project in a single-family residential building. It is effective from 1 January 2019. The tax relief is available to a taxpayer who is the owner or co-owner of a single-family residential building, provided that the thermal modernisation project in the building will be completed within three consecutive years, counting from the end of the tax year in which the first expense has been incurred. The amount of the deduction cannot exceed PLN 53,000.

A thermo-modernisation project is defined as e.g., an improvement resulting in a reduction of the energy demand supplied for heating and hot water and heating of residential buildings, a reduction of primary energy losses in local heating networks and local heat sources supplying them, the construction of a technical connection to a centralised heat source, the total or partial replacement of energy sources with renewable ones or the use of high-efficiency cogeneration.

Methodology for estimating the reduction effect

The reduction effect of this measure has been estimated using data collected in the Central Register of Final Energy Savings, concerning final energy savings achieved (ex-post effect) and planned to be achieved (ex-ante effect), using the CO₂ emission factor for electricity end-users in Poland in 2022.

Measure 37. Improving energy efficiency of residential buildings

Description

Improving the energy efficiency of residential buildings is one of the alternative measures for achieving the national final energy savings target for 2030. The measure was introduced in 2022 and includes

further additional support in this area. It is aimed at improving energy efficiency through the renovation of existing buildings, improving energy efficiency by increasing thermal energy production from low-carbon heat sources, reducing emissions of dust and other pollutants into the atmosphere. Actions taken under this measure include:

- replacement/purchase of a heat source, investment in a central heating and hot water connection (including e.g. connection to a district heating network with connector, purchase of a heat pump, purchase of a condensing gas boiler);
- insulation of building partitions, replacement of window and door frames;
- purchase and installation of windows and doors separating rooms from unheated space;
- purchase and installation of mechanical ventilation with heat recovery;
- installation of hybrid systems, i.e. photovoltaics or a wind power plant together with a heat pump, combined into one system.

The implementing institutions are the National Fund for Environmental Protection and Water Management (NFEP&WM), Voivodship Funds for Environmental Protection and Water Management (VFEP&WM), Local Government Units. Below are the key NFEP&WM and OPI&E 2014–2020 programmes for supporting energy efficiency in residential buildings.

Table 29. Key NFEP&WM, OPI&E 2014–2020 programmes supporting energy efficiency in residential buildings

Name of Programme	Description
Improving air quality by replacing heat sources in multi-family buildings – pilot project in the Zachodniopomorskie Voivodship (West Pomerania)	The aim of the programme is to improve air quality and reduce GHG emissions by replacing heat sources and improving the energy efficiency of multi-family residential buildings with 3 to 20 flats – a pilot project in the Zachodniopomorskie Voivodship. Co-financing is available for projects involving the dismantling of an inefficient solid fuel heat source and the purchase and installation of an air-to-water heat pump with improved energy efficiency class for heating purposes. Additionally, the following may be supported: dismantling, purchase and installation of a new central heating and/or hot water system, purchase and installation of mechanical ventilation with heat recovery, purchase and installation of windows, doors separating the premises from unheated space (also includes dismantling), project documentation.
Improving air quality in the most polluted municipalities – a pilot project in Pszczyna Municipality	The aim of the programme is to improve air quality and reduce GHG emissions by replacing heat sources and improving the energy efficiency of multi-family residential buildings with 3 to 20 flats – a pilot project in the Pszczyna Municipality. Co-financing is available for projects involving the dismantling of an inefficient solid fuel heat source and the purchase and installation of an air-to-water heat pump with improved energy efficiency class for heating purposes. Additionally, the following may be supported: dismantling, purchase and installation of a new central heating and/or hot water system, purchase and installation of mechanical ventilation with heat recovery, purchase and installation of windows, doors separating the premises from unheated space (also includes dismantling), project documentation.
Operational Programme Infrastructure and Environment 2014-2020 Measure 1.3.2. – Supporting energy efficiency in the residential sector	The aim of the programme is to support comprehensive energy modernisation of multi-family residential buildings. The scope of the supported project must result from an ex-ante energy audit and lead to a reduction in final energy consumption by at least 25%. Types of projects eligible for support include insulation of the building envelope, including external walls, floors, roofs and flat roofs, replacement of windows, external doors, replacement of lighting with energy-efficient lighting, etc.
Priority programme on improvement of air quality through replacement of heat sources in multi-family buildings – a pilot project in the Dolnośląskie Voivodship	The aim of the programme is to support investments in the comprehensive energy modernisation of multi-family residential buildings in the Dolnośląskie Voivodship.
Priority Programme Renovation with guaranteed EPC (Energy	The aim of the programme is to improve air quality and reduce GHG emissions through optimised investments in energy efficiency improvements of multi-family residential buildings and public buildings implemented using an Energy Performance Contract (EPC).

Name of Programme	Description
Performance Contract) Plus savings	

Source: study by KOBIZE, IEP-NRI, based on information from NFEP&WM

Methodology for estimating the reduction effect

The reduction effect of this measure has been estimated using data collected in the Central Register of Final Energy Savings, concerning final energy savings achieved (ex-post effect) and planned to be achieved (ex-ante effect), using the CO₂ emission factor for electricity end-users in Poland in 2022.

Measure 38. Improving energy efficiency of the public sector

Description

Energy Efficient Public Sector is one of the alternative policy measures to reduce final energy consumption, implemented for the period 2022-2030. The aim of the programme include:

- disseminating good energy efficiency practices;
- reducing atmospheric emissions through the implementation of investments involving comprehensive thermo-modernisation of buildings leading to energy efficiency;
- improving the energy efficiency of public buildings.

Actions taken under this measure are thermo-modernisation, renovation and low-emission projects within the meaning of the Act on supporting thermo-modernization and renovations and on the central emission register of buildings. The implementing institutions for this measure are the National Fund for Environmental Protection and Water Management (NFEP&WM), Voivodship Funds for Environmental Protection and Water Management (VFEP&WM), Local Government Units. Below are the key NFEP&WM and OPI&E 2014-2020 programmes for supporting energy efficiency in public buildings.

Table 30. Key NFEP&WM and OPI&E 2014—2020 programmes supporting energy efficiency in public buildings

Name of Programme	Description
Energy-efficient Construction Priority Programme. Reducing energy consumption in the construction industry	Support is aimed at reducing air pollutant emissions and achieving energy savings through co-financing of projects related to e.g., insulation of buildings, replacement of windows, replacement of external doors, reconstruction of heating systems, replacement of internal and external lighting of buildings with energy-efficient lighting, development of RES use. Supported modernisations include e.g. hospitals, hospices, hospital outpatient clinics, laboratories, historic buildings, sacred buildings, student residences and others intended for the needs of culture, religious cult, education, care, upbringing, science.
Operational Programme Infrastructure and Environment 2014-2020 Measure 1.3.1. – Supporting energy efficiency in in public buildings	Support is aimed at comprehensive energy modernisation of public buildings to reduce final energy consumption through e.g., insulating the building envelope, including external walls, floors, roofs and flat roofs, replacing windows, external doors, replacing lighting with energy-efficient lighting, reconstruction of heating systems (or connecting a more energy and environmentally efficient heat source, installing/reconstructing cooling systems, including with RES, building and reconstructing ventilation and air-conditioning systems, using weather automation, using building energy management systems, etc.).

Source: study by KOBIZE, IEP-NRI, based on information from NFEP&WM

Methodology for estimating the reduction effect

The reduction effect of this measure has been estimated using data collected in the Central Register of Final Energy Savings, concerning final energy savings achieved (ex-post effect) and planned to be achieved (ex-ante effect), using the CO₂ emission factor for electricity end-users in Poland in 2022.

Measure 39. Technical and construction regulations and requirements defining building design standards

Description

The measure involves tightening technical and building regulations by increasing the requirements in terms of the conditions to be met by buildings, particularly regarding energy efficiency and the implementation of the new EPBD provisions for the construction of zero-emission buildings.

A revised system for assessing and improving the energy efficiency of buildings has been in place in Poland since 2014, operating under the Act on Energy Performance of Buildings and its implementing acts. In addition, the Central Emission Register of Buildings has been established since 1 July 2021 by virtue of the amendment to the Act on supporting thermo-modernization and renovations and on the central emission register of buildings, to collect uniform, standardised and consistent data on buildings and premises and the following that are operated in them: heat sources, including district heating supply, electricity sources and fuel combustion. The register is a tool for central and local government authorities used for the implementation of low-carbon policies. The data collected in the Central Emission Register Buildings comes from several sources, including already existing databases e.g., the central register of energy performance of buildings. The development of Central Emission Register of Buildings has been under way in 2022, with the introduction of additional e-services dedicated to citizens, such as ordering an inspection of chimney flues or ordering a simplified building inventory.

In addition, the Long-Term Building Renovation Strategy has been adopted in 2022, which includes recommendations for the development of public policy in the area of support for building renovation and considers three scenarios (including a recommended scenario) for the thermo-modernisation of the building stock up to 2050.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 40. 'Warm Flat' Priority Programme

Description

The aim of the programme is to improve air quality and reduce particulate matter and GHG emissions by replacing inefficient heat sources and improving energy efficiency in at least 80 000 flats located in multi-family buildings. The programme supports the use of a condensing gas boiler, an upgraded wood pellet boiler, electric heating, an air-to-water heat pump or an air-to-air heat pump or connecting the premises to a common efficient heat source. In addition, it is possible to install central heating and hot water, replace windows and doors, and install mechanical ventilation with heat recovery. The preparation of project documentation for the undertaking is also an eligible cost under the programme. Implementation of the programme complements the target group of beneficiaries of the 'Clean Air' Priority Programme, i.e. owners of single- and multi-family buildings. The distributors of funds in the programme are individual municipalities.

Methodology for estimating the reduction effect

The reduction effect (ex-ante effect) of this measure has been estimated using information on the energy savings planned to be achieved from conventional sources (reduction in energy consumption) as a result of the programme implementation. The methodology also took into account the CO₂

emission factor for electricity end-users in Poland in 2022. The ex-post effect was not estimated due to the lack of the necessary data.

4.2.3. Transport

Key strategic documents and regulations

The following tables summarise the key national policy documents and regulations for the transport sector, affecting its operation and conditioning environmental and climate protection.

Table 31. Key strategic documents in the transport sector

Document title	Document description
implemented	
Government Programme for the Construction of National Roads by 2030 (with an outlook until 2033) adopted by the Council of Ministers on 13 December 2022	Government Programme for the Construction of National Roads by 2030 (with an outlook until 2033) sets out the transport policy objectives for the construction of the TEN-T road network in Poland and complementary road links. It is the largest road programme in the history of Poland. The Government Programme for the Construction of National Roads by 2030 (with an outlook until 2033) assumes the implementation of road investments along national roads, motorways and highways with a total length of over 6,100 km. New investments will include tasks with a length of about 2.6 thousand km, while continued tasks, started under the existing road programme, have a length of over 3.5 thousand km. The aim of the Government Programme for the Construction of National Roads by 2030 (with an outlook until 2033) is to create a coherent network of national roads ensuring the efficient operation of road passenger and freight transport. Improving the capacity of the main arteries is one of the key elements that can increase the development dynamics of both the regions and the country as a whole through easier, faster and cheaper flow of goods and services.
National Road Network Improvement Programme until 2030 (PWKSD) adopted by the Council of Ministers on 4 October 2022	The National Road Network Improvement Programme until 2030 (PWKSD) is a medium-term document concerning the comprehensive maintenance of the national road network. PLN 58.3 billion has been allocated for the implementation of all works included in the Programme. The Programme provides a stable source of funding for the comprehensive maintenance of the growing road network over a multi-year time horizon. The main objectives of the PWKSD are to increase the cohesion of the national road network adapted to the traffic of vehicles with a single axle load of up to 11.5 t, to ensure the required technical condition of the existing infrastructure and to intensify measures reducing the negative impact of the road infrastructure on the environment. The programme planned for the period 2023-2030 assumes the implementation of structural maintenance (comprehensive extensions and reconstructions), current maintenance (routinely performed renovation, repair, maintenance and cleaning works) and piloting new maintenance solutions reducing the negative impact on the environment by the entire network of national roads (including highways and motorways) managed by the General Director for National Roads and Motorways.
National Urban Policy 2030 adopted by the Council of Ministers on 14 June 2022	The strategic objective of the National Urban Policy 2030 (NUP 2030) is to build conditions for strengthening the capacity of cities and urban functional areas for sustainable development, improving the quality of life of their inhabitants and building resilience to observed climate change. Priority is given to the development of public transport and its integration while introducing restrictions on the environmental nuisance of car transport. In parallel, emphasis is placed on opening up public spaces to promote walking, cycling and micromobility. Measures to optimise traffic flows, including their speed, parking policy or the promotion of city logistics services are of key importance. One of the main benefits of promoting measures in this area is the reduction of energy consumption and emissions. NUP 2030 assumes that road investments should be carried out according to established principles and focus on completing the basic transport system of the city and its functional area. The existing system should be modernised to improve it in order to ensure its coherence with the priorities of the urban transport policy. Solutions should be established to change the way street space is shaped in urban agglomerations, and investments should be made in the public transport system, ensuring broad integration of this system.
National Road Safety Programme 2021-2030 adopted by the National Road Safety Council in December 2021	Programme of measures by government administration aimed at realisation, in terms of road traffic safety (RTS), of the main and specific objectives to reduce the number of road accidents resulting in fatalities or serious injuries. The programme is a diagnosis and assessment of the state of RTS in Poland and takes into account Polish and European conditions of RTS programming.

Document title	Document description
Strategy for Sustainable Transport Development 2030 (STD2030) adopted by the Council of Ministers on 24 September 2019	The Strategy for Sustainable Transport Development 2030 (STD2030) is one of the development strategies stemming from the Strategy for Responsible Development. The main objective of the STD2030 is to increase transport accessibility while improving the safety of traffic participants and the efficiency of the transport sector by creating a coherent, sustainable, innovative and user-friendly transport system at national, European and global levels. The directions of intervention included in the STD2030 are construction of an integrated, interconnected transport network serving the competitive economy, improvement of the way the transport system is organised and managed, changes in individual and collective mobility, improvement of the safety of traffic participants and transported goods, reduction of the negative impact of transport on the environment, improvement of the efficiency of the use of public funds for transport projects.
Clean Transport Package adopted by the Council of Ministers on 16 March 2017, including the Electromobility Development Plan in Poland – Energy to the Future and National Policy Framework for the Development of Alternative Fuel Infrastructure	The Clean Transport Package consists of two documents – the Electromobility Development Plan in Poland and the National Policy Framework for the Development of Alternative Fuel Infrastructure. The main objective of the package is to create conditions for the development of electromobility, the development of the electromobility industry, the stabilisation of the electricity grid through the integration of vehicles into it. The Electromobility Development Plan in Poland defines the areas and phases of electromobility development, together with a proposal for intervention tools. The Plan includes stages of intervention e.g., promotion of electric vehicles as a means of urban transport, development of the vehicle market, financing the electromobility industry, regulation for electromobility development, smart network integrated with the vehicle market. The aim of the Plan is to develop the electromobility industry in Poland and create conditions for its growth and to stabilise the electricity grid. The document National Policy Framework for the Development of Alternative Fuel Infrastructure contains an analysis of the current state of development of alternative fuels in Poland, a diagnosis of barriers to further popularisation of these fuels, definition of objectives for infrastructure development, a proposal of instruments to support infrastructure construction and vehicle market development. The target set for 2025 is the development of charging infrastructure, as well as the reduction of emissions of harmful compounds by transport. It is assumed that electrification of transport should take place mainly in agglomerations and densely populated areas.
Policy for the Development of Civil Aviation in Poland until 2030 (with an outlook to 2040) adopted by the Council of Ministers on 21 November 2023	Policy for the Development of Civil Aviation in Poland until 2030 (with an outlook to 2040) sets out the main objectives, directions and means of creating and implementing government policy related to civil aviation. The document sets out directions for intervention concerning e.g., the development of a network of airports and the aviation market, investment in airports, the functioning of airspace, as well as support for research, education and development in the area of civil aviation. In addition, the new policy creates conditions for ensuring a high level of safety and security in civil aviation, environmental protection in air transport and strengthening the position of Poland and Polish aviation entities on the international arena.
National Railway Programme to 2030 (with an outlook to 2032), adopted by the Council of Ministers on 14 November 2023	The National Railway Programme (NRP) is a multi-annual programme covering investments on railway lines, which are co-financed by the minister in charge of transport. The document defines the volume and sources of funding (including EU and national funds) and provides the basis for ensuring investment financing in accordance with the Act on Public Finance. As a result of the update adopted by the Council of Ministers on 16 August 2023, the name of the programme was changed to the National Railway Programme to 2030 (with an outlook to 2032). Thus, the duration of the programme was adjusted to the EU financial perspective 2021-2027, with some projects planned to be implemented until 2032. The first version of the NRP, related to the 2014-2020 perspective, was adopted by the Council of Ministers on 15 September 2015. The document has replaced the Multi-Annual Railway Investment Programme.
'Government programme to support the tasks of railway infrastructure managers, including maintenance and renovation, until 2028', adopted by the Council of Ministers on 7 November 2023	The programme is a continuation of the 5-year programme entitled 'Government programme to support the tasks of railway infrastructure managers, including maintenance and renovation, until 2023'. The Programme establishes the financial framework and conditions for the implementation of the State's intentions in the area of railway infrastructure management. The main benefits of the Programme include ensuring an appropriate level of quality of railway infrastructure, elimination of maintenance backlogs, preservation of the network of railway lines and long-term contracts for maintenance and repair of railway lines. The programme is financed from the state budget and the Railway Fund. A total limit of PLN 49 216.5 million, including PLN 44 005.4 million from the state budget, has been assumed from public funds for its implementation in 2024—2028.
The multi-annual programme 'Comprehensive Development of the	The multi-annual programme 'Comprehensive Development of the Lower Vistula River' includes the construction of a barrage on the Vistula below Włocławek in Siarzewo by 2032. The implementation of the programme will complement the projects implemented under the documents: National Shipping Programme until 2030 and the multi-annual programme

Document title	Document description
Lower Vistula River' adopted by the Council of Ministers on 10 October 2023	Management of Water Resources in Poland. The construction of hydrotechnical infrastructure will translate into the development of the Lower Vistula River. The implementation of the investment will contribute to the development of conditions for inland waterway transport and the strengthening of the integration of maritime ports located at the mouth of the Vistula with the hinterland. It will also result in the production of energy from RES, increase the level of security of the national energy system and improve the functioning of water management on regional basis.
National Shipping Programme until 2030 (NSP2030) adopted by the Council of Ministers on 3 October 2023	The National Shipping Programme until 2030 is aimed at increasing the role of inland waterway transport nationally and locally. It envisages more than 20 tasks of a sectoral nature and 11 investment measures to ensure the proper functioning of inland waterway transport on transport-used access sections to maritime ports (on the Oder from Gliwice to the seaports in Szczecin and Świnoujście, on the Vistula from Toruń to the Port of Gdańsk). Within the framework of the NSP2030, sectoral measures will be taken to e.g., shape the conditions for the development of inland terminals and the integration of inland waterway transport into the intermodal transport system; support for the transformation of the inland waterway fleet towards low- and zero-emission and climate-resilient vessels, including operation at reduced water levels; the development of a River Information Service (RIS) System to enable safer and more economical inland waterway transport; and measures leading to the digitalisation of processes related to the operation of waterway market operators.
Intermodal transport development directions to 2030 with an outlook to 2040 adopted by the Council of Ministers on 22 August 2022	The document presents transport trends and forecasts for the development of intermodal transport and identifies barriers to its growth. It also defines the vision, which is to increase the importance of Poland in global supply chains, and the main target, which is to create optimal conditions for inter-industry integration of the Polish transport system and to increase the use of rail transport in intermodal transport. It is envisaged that the main target will be realised through three specific objectives concerning the support of multimodal logistic chains, measures strengthening the competitive position of intermodal transport against other transport modes and the use of modern technologies supporting the organisation and development of intermodal transport. The document defines a system for monitoring and evaluation of the objectives set for intermodal transport.
Governmental program for the construction or modernisation of railway stops for 2021-2025 (Railway Stop Programme) adopted by the Council of Ministers on 19 May 2021	The programme provides for the modernisation of existing and the construction of new railway stops in towns and cities which are crossed by railway lines but where there is no suitable infrastructure for travellers. Through the construction of new stops, passengers hitherto not using the railway will gain access to this form of transport and will be able to abandon private car transport in its favour.
Central Communication Port Investment Programme (CPK Programme) adopted by the Council of Ministers on 28 October 2020	The CPK Programme includes e.g. new railway lines as the core of a modernised national railway transport system as an attractive alternative to road transport. The construction of almost 2 000 km of new high-performance lines, much of it to High Speed Rail standard, is assumed. The CPK Programme implements the provisions of the Strategy for Sustainable Transport Development 2030, indicating the construction of a national rail transport system based on the CPK node within the framework of the Strategic Project: Construction of CPK. These lines are also indicated on the maps of the railway network in Poland in 2030.
Local and Regional Rail Infrastructure Completion Programme – Rail+ to 2029 (Rail+ Programme) adopted by the Council of Ministers on 3 December 2019	The main target of the Programme is to supplement/improve railway connections between towns with a population of more than 10 000 inhabitants and voivodship capitals, which will contribute to the elimination of transport exclusion thanks to the possibility of supplementing the railway network with new connections, which will above all provide passengers with access to inter-voivodship transport. The effect of the Programme will be an improvement in the living conditions of residents, the improvement of daily journeys, and the possibility of presenting a transport offer more suited to the needs of the local community.
Government programme to support the tasks of railway infrastructure managers, including maintenance and	The Programme establishes the financial framework and conditions for the implementation of the State's intentions in the area of railway infrastructure management. The primary objective of the programme is to strengthen the role of rail transport in the country's integrated transport system by reversing the downward trend in the share of rail transport in freight and providing the necessary funds for maintenance and repair works on the existing rail network. These works will allow the technical parameters of the modernised railway lines to be maintained

Document title	Document description
renovation, until 2030, adopted by the Council of Ministers on 16 January 2018	and the situation on the remaining lines to be systematically improved. The main benefits of the Programme are the assurance of an adequate level of quality of the railway infrastructure, the elimination of the maintenance backlog, the preservation of the railway network and multi-year contracts for the maintenance and repair of railway lines. A total of PLN 23 841.2 million, including PLN 16 308.9 million from the state budget, has been allocated from public funds for the implementation of the programme in 2019-2023.
Railway Stations Investment Programme 2016 - 2023 adopted by the Council of Ministers on 14 February 2017	The programme is one of the projects planned for implementation as part of the 'Strategy for Responsible Development for the period up to 2020 (including the perspective up to 2030)'. Thanks to it, 179 railway station investments will be carried out for a total amount of over PLN 2.51 billion. As a result of the measures taken at the stations, the level of passenger service will be improved, and railways will be integrated with other modes of transport. The end result of the Programme will be standardised, high quality railway stations, adapted to the needs of passengers and the transport system, while responding to local conditions. Railway stations will meet the real needs of local communities, providing modal shift functions to encourage travellers to use rail. As part of the Programme's investments, it is envisaged that energy-saving solutions will be implemented, reducing the maintenance costs of the stations. A uniform building standard will allow for the development of a coherent station property management policy.
Programme for the development of Polish seaports until 2030 adopted by the Council of Ministers on 17 September 2019	The main objective of the programme is to permanently strengthen Polish seaports as leaders among the seaports of the Baltic Sea basin, acting as key hubs of global supply chains for Central and Eastern Europe, and to increase their contribution to the socio-economic development of the country. The programme contributes to an increase in the income of Polish residents by improving the operating conditions of seaports, which will be accompanied e.g., by the handling of a larger volume of cargo there, as well as by an increase in the transport accessibility of port centres and an improvement in the conditions for providing services related to the transport of goods and passengers – thanks to e.g., the construction, modernisation and mutual integration of the linear infrastructure providing access to ports from land and sea, in accordance with the idea of intermodality. The programme directs the development of Polish seaports so that by 2030 the volume of transshipments through them should exceed 150 million tonnes. The effects of implementing the Programme will also include an increase in the reloading potential of seaports, as well as an increase in the gross capacity of units handled by seaports. The value of the tasks included in the projected Programme amounts to approx. PLN 40 billion.
National Implementation Plan for the Technical Interoperability Specification 'Steering' from June 2024	The purpose of this plan is to provide railway undertakings with information on the timetable for the deployment of the ERTMS system in Poland to enable them to plan their business activities accordingly in the context of the gradual equipping of their traction units with the on-board equipment of the system. The National Implementation Plan for the Technical Interoperability Specification has been developed in such a way that the implementation of the Technical Interoperability Specification in Poland in respect of the 'Steering' and Signalling subsystems is directed towards increasing the coherence of the whole railway system of the European Union and has a positive impact on the profitability of the railway system in Poland.
Assumptions to the development plans for inland waterways in Poland for 2016-2020 with an outlook to 2030, adopted by the Council of Ministers on 14 June 2016	A document of a directional nature setting out general assumptions for the development of inland waterway transport, which are further specified in the National Shipping Programme until 2030. It provides a basis for the development of plans for the modernisation or construction of missing sections of the most important waterways in Poland. The document presents an analysis of the current status of the most important national inland waterways and focuses on measures aimed at restoring their transport and economic functions, i.e. ensuring navigability parameters compatible with at least Class IV navigability and meeting the requirements of inland waterway transport infrastructure for the TEN-T network. Funding for the projects to be implemented will come from the Cohesion Fund, the European Regional Development Fund, the Connecting Europe Facility (CEF), the European Fund for Strategic Investments, earmarked funds e.g., funds from the National Fund for Environmental Protection and Water Management or funds from the Inland Waterway Transport Fund, as well as funds from the state budget, local governments, investors from the sectors concerned and funds earmarked for the implementation of tasks included in the Strategy for Responsible Development.
Maritime Policy of the Republic of Poland adopted by the Council of Ministers on 17 March 2015	The Maritime Policy of the Republic of Poland sets out the directions for sustainable socio-economic development and rational use of Poland's coastal location. The Maritime Policy of the Republic of Poland is based on the constitutional principle of sustainable development. It contains basic objectives aimed at the comprehensive use of Poland's maritime potential, including the development of the maritime economy, related to the use of the sea, as well as methods and legal and economic instruments for the implementation of these objectives in the current political and socio-economic conditions. The Maritime Policy of the Republic of Poland covers the areas of political, socio-economic, scientific and cultural life of the country. The most important directions

Document title	Document description
	of Poland's development in the field of maritime affairs until 2030 are: strengthening the position of Polish seaports, increasing the competitiveness of maritime transport and employment in the maritime economy, and ensuring safety at sea. The maritime policy of the Republic of Poland is implemented through participation in marine environmental protection activities at EU forums, IMO and within the Helsinki/HELCOM Commission, in order to fulfil legal obligations to protect the Baltic Sea marine environment, including the reduction of GHG emissions from ships, sampling procedures and verification of sulphur content in marine fuels, and increasing the presence of alternative fuels.

Source: study by KOBiZE, IEP-NRI

Table 32. Key regulations in the transport sector

Document title	Document description
Regulation of the Minister of Infrastructure of 4 December 2020 on the plan for sustainable development of public collective transport in inter-voivodship and international passenger carriage and in voivodship passenger carriage by rail (Journal of Laws of 2020, item 2328)	The plan established by this regulation formulates the basic rules for the operation and development of inter-voivodship and international passenger rail transport services provided as public services, within the framework of public mass transport, on a market subject to regulated competition. The plan is based on the decisions of strategic government documents programming the development of the country, in which, in the case of rail transport, the necessity to minimise the negative impact on the environment is indicated.
Act of 23 October 2018 on the Local Government Road Fund (Journal of Laws of 2023, item 1983)	The Act sets out the rules for the operation of the Local Government Roads Fund, the accumulation of the Fund's resources, the provision of subsidies and funding from the Fund's resources. The Fund is a state special purpose fund. The minister in charge of transport is the administrator of the Fund. The Fund collects financial resources for tasks involving construction, reconstruction or renovation of district and municipal roads, construction of bridges located along voivodship, district or municipal roads, construction, reconstruction or renovation of voivodship, district or municipal roads of defence importance. In 2020, by virtue of the Act of 19 November 2020 amending the Act on the Local Government Road Fund and certain other acts (Journal of Laws of 2023, item 2338), the name of the fund was changed to the 'Government Road Construction Fund (GRCF)'.
Act of 11 January 2018 on electromobility and alternative fuels (Journal of Laws of 2024, item 1289,)	The basis for drafting the Act was the Electromobility Development Plan in Poland and the National Policy Framework for the Development of Alternative Fuel Infrastructure. It is the first regulation that comprehensively defines the principles of functioning of the market for alternative fuels in transport. The Act sets out rules for the development and operation of infrastructure for the use of alternative fuels in transport, including the technical requirements to be met by that infrastructure, the obligations of public entities regarding the development of alternative fuels infrastructure, information obligations regarding alternative fuels, conditions for the operation of clean transport zones and the national policy framework for the development of alternative fuels infrastructure and the manner of its implementation. Under this Act, there will be more favourable rules, passenger car consumption allowances for electric vehicles, hydrogen-powered vehicles and vehicles emitting less than 50 g of CO ₂ per km.
Regulation of the Minister of Economy of 30 April 2014 on the detailed requirements for internal-combustion engines in terms of limiting the emission of gaseous and particulate pollutants by these engines	The Regulation lays down specific requirements for internal-combustion engines to be installed in non-road mobile machinery as well as auxiliary engines to be installed in vehicles used for the transport of persons or goods on the road, in terms of the limitation of emissions of gaseous and particulate pollutants by those engines. New engines, whether or not installed in non-road mobile machinery, may be placed on the market if they meet the technical requirements and for which a type-approval certificate has been issued.

Document title	Document description
(Journal of Laws of 2014, item 588)	
Act of 16 December 2010 on public collective transport (Journal of Laws of 2023, item 2778)	The Act sets out the principles of organisation and operation of regular passenger transport in public collective transport carried out on the territory of Poland and in the cross-border zone, by road, rail, other railway, rope, rope and land transport, maritime transport and inland waterway transport. It also refers to the principles of financing regular passenger transport in public collective transport with regard to public utility transport.
Act of 6 December 2008 on excise duty (Journal of Laws of 2023, item 1542, as amended)	The Act sets out the excise duty rates for excise goods, including motor petrol and diesel. The 2019 amendment to the Act (Journal of Laws of 2019, item 864) introduced preferential excise rates by applying a zero excise rate to natural gas intended for the propulsion of internal combustion engines (CN 2711 11 00 and 2711 21 00), i.e. liquefied natural gas LNG and compressed natural gas CNG, and to biogas (regardless of CN code), hydrogen and biohydrogen (CN 2804 10 00) intended for the propulsion of internal-combustion engines. The 2018 amendment to the Act introduces an exemption from excise duty that applies to electric, plug-in hybrid or hydrogen-powered vehicles.
Act of 25 August 2006 on bio-components and liquid biofuels (Journal of Laws of 2024, item 20)	The Act sets out the rules for performing economic activity in the production of bio-components, import or intra-Community purchase of bio-components, the production of liquid biofuels by farmers for their own use, performing economic activity in the marketing of bio-components and liquid biofuels and the determination and implementation of the National Indicative Target, confirming the fulfilment of sustainability criteria, performing economic activity in granting permission to use a recognised certification system and performing economic activity in issuing certificates. In addition, it regulates the rules for carrying out inspections and reporting and the procedure for submitting reports.
Act of 25 August 2006 on the system of monitoring and controlling fuel quality (Journal of Laws of 2023, item 846, as amended)	The Act sets out the rules for the organisation and operation of a system for monitoring and controlling the quality of fuels intended for use in different types of vehicles and for monitoring and applying certain measures to reduce GHG emissions during the life cycle of fuels used in transport and electricity used in motor vehicles. The law defines the NRT (National Reduction Target), where GHG emissions from fuels used in transport must be reduced by 6% compared to 2010 values. The amendment to the Act of 27 October 2022 repealed the provisions that oblige entrepreneurs carrying out the business of marketing motor gasoline containing bioethanol or ether at service stations to also market motor gasoline with a specific content of oxygen and bioethanol or ether at these stations.
Act of 26 July 1991 on natural persons' income tax (Journal of Laws of 2024, item 226, as amended), Act of 15 February 1992 on corporate income tax (Journal of Laws of 2023, item 2805, as amended)	An amendment to the 2020 Act introduces an exemption from PIT and CIT as support for the purchase of electric cars for individuals and legal entities provided by the Low Emission Transport Fund.
Act of 31 July 2019 on financial support for inland shipowners, the Inland Waterway Transport Fund and the Reserve Fund (Journal of Laws of 2021, item 503)	The Act regulates the provision of financial support to inland shipowners and the operation of the Inland Waterway Transport Fund. At the shipowner's request, a preferential loan is granted to co-finance the purchase, modernisation or repair of a vessel. It is possible to receive a loan under preferential conditions clearly defined in the Act.
Regulation of the Minister of Infrastructure and Development of 7 October 2015 on requirements for the sulphur content in marine fuel, including the manner of its determination	The Regulation sets out requirements for the sulphur content in marine fuel, including how it shall be determined. The sulphur content in marine diesel fuel designated as marine fuel defined for DMB grades in Table I of PN-ISO 8217 'Petroleum products – Fuels (Class F) – Specification for marine fuels', placed on the market in the territory of the Republic of Poland, must not exceed 1.50% m/m. The sulphur content in marine gas oil as defined for DMX, DMA and DMZ grades in Table I of PN-ISO 8217 'Petroleum products – Fuels (Class F) – Specification for marine fuels', used or placed on the market in the territory of the Republic of Poland, must not exceed 0.10% m/m.

Document title	Document description
(Journal of Laws of 2024, item 326)	
Act of 18 August 2011 on maritime safety (Journal of Laws of 2024, item 1068)	The Act regulates matters of maritime safety with respect to the construction of the ship, its fixed installations and equipment, the inspection of the ship, the qualifications and composition of the ship's crew, the safe practice of maritime transport and the saving of life at sea. The Act sets out how vessel traffic shall be monitored, including the management and supervision of vessel traffic.
Act of 16 December 2005 on the Railway Fund (Journal of Laws of 2024, item 1133)	The Act regulates the establishment of the Railway Fund and the rules for the accumulation of resources by this Fund and the rules for the financing of tasks from its resources. This Fund has been established at Bank Gospodarstwa Krajowego.
Act of 28 March 2003 on railway transport (Journal of Laws of 2024, item 697)	The Act (Article 38c) stipulates that investments involving railway lines shall be carried out within the framework of a multi-year programme in terms of public finance regulations. The multi-year programme specifies the material and financial scope of the planned railway investments, for a period of not less than 3 years. The multiannual programme shall include all investments carried out with funds at the disposal of the minister in charge of transport. The multiannual programme shall include, in particular, a timetable for the preparation and implementation of individual investments, broken down into annual stages, and shall indicate all sources of funding for the investments. The multiannual programme shall indicate whether a given investment concerns a railway line of national importance and whether a given investment is co-financed from funds originating from the budget of the European Union. By 31 May each year, the minister in charge of transport, in agreement with the minister in charge of public finance and, with regard to projects implemented with the participation of European funds, with the minister in charge of regional development, shall submit to the Council of Ministers a report on the implementation of the plan for the execution of the multiannual programme for the previous year.
Act of 16 March 1995 on the prevention of marine pollution by ships (Journal of Laws of 2023, item 1072)	The Act supports the application of the requirements of EU Regulation 2015/757 and implements into Polish law the requirements of the MARPOL Convention, which relate to the energy efficiency of ships. EU Regulation 2015/757, as amended by EU Regulation 2023/957, establishes provisions to monitor, report and verify GHG emissions and other relevant information from ships arriving at, within or departing from ports under the jurisdiction of EU MS. The aim is to reduce emissions from maritime transport in a cost-effective manner. The Act of 7 November 2014 amending the Act on the prevention of marine pollution by ships and certain other acts (Journal of Laws of 2014, item 1554), introduced energy efficiency requirements – the Energy Efficiency Design Index (EEDI) for new ships and the Ship Energy Efficiency Management Plan (SEEMP). The EEDI allows for the appropriate selection of equipment and the determination of the energy efficiency of the ship at the design level. The SEEMP contains a description of measures leading to a reduction of the energy consumption of the equipment installed on board and recommendations for the implementation of an appropriate strategy in the planning of the sea voyage (minimising energy consumption), promoting energy-efficient behaviour among the ship's crew and shore personnel.

Source: study by KOBiZE, IEP-NRI

Policies and measures

Measure 41. Development of road infrastructure

Description

Development of road infrastructure includes Intelligent Transportation Systems (ITS) within the framework of the National Traffic Management System, increasing the cohesion of national roads (including the construction of expressways, highways on the TEN-T network and bypasses along existing national roads), the Government Road Construction Fund. The main objective is investment activities, implemented with the disbursed assistance of the National Road Fund and Government Road Construction Fund (GRCF). The measure contributes to improving road safety, relieving congestion in agglomerations and cities, and reducing unit GHG emissions from road transport.

Intelligent Transportation Systems (ITS)

Intelligent Transportation Systems (ITS) support the operational management of road traffic, public transport (passenger), freight transport, emergency services, as well as support the solution of transportation problems, while allowing to give appropriate priority to the handling of individual traffic

streams. The goal is to build and implement a unified, integrated system to enable the launch of ITS services of greatest importance to drivers. The project of the National Traffic Management System includes the implementation of ITS on a selected part of the TEN-T core network. The ITS system enables dynamic traffic management to improve safety and increase the fluidity of road transportation.

Improving the consistency of national roads

Priority is being given to the construction of sections that complement the existing main transport corridors so that long-distance fluidity is ensured. The investments undertaken are adapted to existing and expected traffic volumes. It is important to ensure the cohesion of national roads with other categories of public roads as well as integration with other modes of transport. Investment priorities needed to complete the Trans-European Transport Network TEN-T (as part of the completion of the target network of motorways and expressways), as well as the construction of bypasses for selected cities, are included. Tasks are implemented within the framework of the National Roads Construction Programme 2014-2023 (with an outlook to 2025) and its successor, the Government's National Roads Construction Programme to 2030 (with an outlook to 2033) and the Programme for the Construction of 100 Bypasses for 2020-2030.

Government Road Construction Fund (GRCF)

The Fund is an instrument for supporting the implementation of road investments by local government public road managers. The purpose of the Fund is to raise the level and quality of life of local communities and to increase the efficiency of public institutions through the development of safe, coherent, functional and efficient road infrastructure, as support for the activities of municipal and district governments for the construction of local roads of key importance for the sustainable social and economic development of local communities. The development of local road infrastructure is a complementary action to the initiatives undertaken at the national level concerning the construction of the motorway and expressway system, contributing to the creation of a coherent and integrated transport system. The Government Road Construction Fund (GRCF) mainly supports tasks involving the construction, reconstruction or renovation of roads, bridges, bypasses, access to intermodal terminals or zones, footpaths, cycle paths, pedestrian crossings, bicycle crossings and bus stop platforms together with access to these platforms.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 42. Development of public transport

Description

The development of public transport includes the development of urban transport networks, the 'Common Ticket' project, the obligation to develop sustainable public transport development plans, the development of public transport in cities, as well as the promotion of the use of public transport and the implementation of urban transport investments. The measure implements e.g., the obligations contained in the Strategy for Sustainable Transport Development 2030 through the development of public collective transport in cities or the implementation of the 'Common Ticket' project.

Development of urban public transport

The development of public transport in cities aims to increase the use of low-emission urban transport in serving the inhabitants of cities' functional areas. Such measures are implemented e.g., in the Operational Programme Infrastructure and Environment 2014-2020 under Priority Axis VI Development of low-emission public transport in the cities. Support is provided for both infrastructure and rolling stock investments that aim to reduce urban congestion, improve traffic flow and reduce the negative environmental impact of transport in cities and their functional areas. Beneficiaries of the support measure are local government units and their associations – voivodship cities and their functional areas.

'Common Ticket' project

The 'Common Ticket' project involves the ticketing integration of rail passenger transport with other means of public collective transport. The aim of the project is to make the service available by creating the possibility for travellers to purchase a single ticket for the entire journey – regardless of the sales channel, carrier and on which routes they travel. The measure covers all regions of Poland based on tariff integration within the industry and operates within regional/agglomeration transport systems, providing an alternative to individual car transport.

Development of urban transport networks

The development of urban transport networks aims at the development of efficient and reliable transport networks in urban functional areas with a particular emphasis on the dissemination of public transport and the promotion of cycling and walking.

Obligation to prepare plans for the sustainable development of public collective transport

The obligation for local government units to draw up transport plans, in the case of organising transport of a public utility nature, was introduced by the Act of 16 December 2010 on public collective transport. Transport plans specify, in particular: the transport network on which public transport is planned, the assessment and forecast of transport needs, the envisaged financing of transport services, preferences regarding the choice of means of transport, principles of organising the transport market, the desired standard of transport services in public transport, the envisaged method of organising the system of information for passengers. In addition, the plan specifies the lines of communication on which the use of electric or natural gas-powered vehicles is envisaged and the planned date of their commencement.

Coordination at national level of the European Mobility Week (EMW, in previous years called European Sustainable Transport Week – ESTW) campaign

At national level, the Ministry of Infrastructure coordinates the EMW campaign, initiated by the European Commission in 2002 and held annually from 16 to 22 September. The aim of the campaign is to promote sustainable mobility behaviour. Local authorities, NGOs and private actors are encouraged to organise events to celebrate the EMW and to promote low and zero-emission modes of transport, in particular the use of public transport, cycling and walking. The activities culminate in the World Car Free Day celebrated on 22 September.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 43. Development of zero-emission urban transport***Description***

The development of zero-emission urban transport includes the creation of clean transport zones, promotion of zero-emission public transport, promotion of cycling and walking, support for the preparation and implementation of Sustainable Urban Mobility Plans, and NFEP&WM programmes supporting the development of zero-emission public transport. The main objective of this measure is to avoid GHG emissions by co-financing projects to reduce energy and fuel consumption in public transport through the development of zero-emission urban transport, improving social behaviour and promoting a shift to alternative forms of transport e.g., cycling and walking.

Establishment of clean transport zones

To prevent negative impacts on human health and the environment from transport emissions, a clean transport zone may be established in an area of dense residential development with a high concentration of public buildings, to which the entry of vehicles other than electric, hydrogen-powered, natural gas-powered will be restricted. The list of vehicles authorised to use the zone may be extended by the local municipality authorities to include internal combustion vehicles meeting selected emission standards. The boundaries of the clean transport zone area shall be marked with road signs and vehicles allowed to enter the Clean Transport Zone must have appropriate stickers. The clean transport zone shall be established by resolution of the municipal council. Entry to such a zone by vehicles other than the three types mentioned above shall be charged. The first clean transport zone was launched on 1 July 2024 in Warsaw.

Development of zero-emission public transport

The development of zero-emission public transport imposes requirements on local government units for the organisation of public transport. A local government unit, with the exception of municipalities and districts with a population of less than 50 000, provides or contracts the provision of urban transport services to an entity whose share of zero-emission buses in the fleet of vehicles in use on the territory of that local government unit is at least 30%. Another significant instrument for the development of urban public transport is the support from EU funds for investment in low-emission bus and trolleybus fleets as well as urban infrastructure and rolling stock (trams and subways).

Promotion of cycling and walking

The promotion of cycling and walking is aimed at improving social behaviour and switching to alternative forms of transport e.g., cycling and walking. The aim is i.e. to encourage cycling by:

- expanding the infrastructure of cycle paths and cycle parking facilities, ensuring safe use of bicycles;
- improving the public bike rental system (Veturilo);
- creation of parking facilities in the Bike+Ride system;
- institutional strengthening of municipal units dealing with cycling.

Support for the preparation and implementation of Sustainable Urban Mobility Plans (SUMPs)

A pilot programme to support the development of Sustainable Urban Mobility Plans, funded by the Operational Programme Infrastructure and Environment 2014 - 2020, was implemented from 2019 to 2023. This pilot programme was organised by the Ministry of Development Funds and Regional Policy, in cooperation with the Ministry of Infrastructure, the Centre for EU Transport Projects (CEUTP), the European Commission and the JASPERS Initiative. It was aimed at all interested cities and urban

functional areas and was a preparation for the next financial perspective. Its implementation ended in June 2023 with 30 functional areas supported during SUMP development.

As a continuation of the advisory support to cities/functional areas, based on the EU's Technical Support Instrument (TSI), the Ministry of Infrastructure has become the main beneficiary and coordinator of the project *Support for Polish cities/urban areas/metropolitan areas in the preparation of sustainable urban mobility plans*. The direct beneficiaries of the project are 15 cities/urban areas/metropolitan areas that receive advisory support in the SUMP preparation process, under the technical assistance offered by the European Commission. The project implementation lasts until May 2025.

NFEP&WM programmes for the development of zero-emission urban transport

NFEP&WM runs a number of programmes to support the development of zero-emission transport, the key programmes relating to zero-emission urban transport are shown in the table below.

Table 33. Key NFEP&WM programmes for the development of zero-emission urban transport

Name of Programme	Description
'Cheetah II' Programme	The objective of the Programme is to avoid emissions of air pollutants by co-financing projects aimed at reducing fuel consumption in public transport of the Silesia region. The programme provides for support for projects aimed at avoiding air pollution and reducing fuel consumption in public transport through the development of zero-emission public transport. Programme completed.
'Green Public Transport' Programme	The aim of the programme is to co-finance projects intended to reduce the use of emission fuels in public transport through the acquisition/leasing of new electric buses using electricity accumulated by connection to an external power source or using electricity generated from hydrogen for propulsion, the acquisition/leasing of new trolleybuses, as well as the training of drivers/mechanics in the operation of emission-free vehicles, the modernisation or construction of infrastructure, including hydrogen charging or refuelling points. The infrastructure is used exclusively for the operation of public transport.

Source: study by KOBiZE, IEP-NRI, based on information from NFEP&WM

Methodology for estimating the reduction effect

The methodology for estimating the reduction effect of this measure is based on the assumption that if the measure would not have been implemented, then all urban electric buses in a given year would have been diesel-powered internal combustion buses. Therefore, the reduction effect is the avoided emissions equal to the emissions of diesel-powered internal combustion buses in the number and mileage corresponding to the electric buses in a given year. To calculate the ex-post effect, historical data collected for the development of the emission inventory has been used. The ex-ante effect has not been estimated due to the lack of the necessary data.

Measure 44. Development of electromobility

Description

Electromobility development includes its promotion, obligation for public administration to replace the fleet with electric vehicles, construction of charging infrastructure at public buildings, tax preferences, development of infrastructure for charging electric vehicles, application of soft support instruments for users of zero-emission vehicles, support for innovation in the area of electromobility, as well as programmes financed by NFEP&WM. The main objective of the measure is to create conditions for the development of electromobility in Poland. Thus, it aims to generate increased interest and public support for electromobility development and the popularisation of electric vehicles.

Obligation for public administrations to replace their fleets with electric vehicles

The obligation for public administrations to replace their fleets with electric vehicles aims to give a boost to electromobility by creating future demand and generating interest among the public regarding electromobility.

Construction of charging infrastructure at public buildings

The construction of charging infrastructure at public buildings aims to increase public interest in electric vehicles. The target for 2025 is that each public building should be equipped with at least one publicly accessible charging point having a charging capacity of no less than 3.7 kW.

Tax preferences

The existing excise and income tax preferences for zero- and low-emission vehicles provide an instrument to support the development of electromobility and to encourage public interest in electromobility. The excise tax exemption applies to electric, hydrogen (indefinite) and plug-in hybrid vehicles with an internal combustion engine capacity not exceeding 2000 cm³ (timely exemption). Currently, pursuant to the Act of 1 December 2022 amending the Act on Excise Duty and certain other acts (Journal of Laws item 2707), the excise duty exemption previously in force until 31 December 2022 for passenger cars that are plug-in hybrid vehicles with an internal combustion engine capacity not exceeding 2000 cm³ has been extended until 31 December 2029. For other hybrid vehicles with an engine capacity of up to 3500 cm³, halved excise duty rates apply from 1 January 2020, varying according to the type of hybrid and the capacity of the internal combustion engine. In addition, NFEP&WM funding for the purchase of new vehicles powered by liquid biofuels, compressed natural gas (CNG), liquefied natural gas (LNG), including those derived from biomethane, hydrogen or using electricity for propulsion is also exempt from income tax.

Development of infrastructure for charging electric vehicles

Development of infrastructure for charging electric vehicles is about creating conditions for the development of electromobility in Poland through the popularisation of charging infrastructure and the stabilisation of the electricity grid through the integration of vehicles with the network.

Application of soft support instruments for users of zero-emission vehicles

Application of soft support instruments for users of zero-emission vehicles introduces solutions for users of electric vehicles such as enabling the use of bus lanes, free parking in paid parking zones or the possibility of entering clean transport zones. The aim is to encourage the purchase of electric cars.

Support for innovation in the area of electromobility

Support for innovation in the area of electromobility aims to subsidise the research needs of the electromobility industry. In addition, the objective is to finance measures to develop and popularise the use of electricity and alternative fuels in transport. Funding is provided for education, research and development as well as investment activities to support producers of bio-components, the construction of charging and distribution stations for alternative fuels and the purchase of vehicles by local government units as well as entrepreneurs.

NFEP&WM programmes for the development of electromobility

NFEP&WM is implementing a number of programmes for electromobility development, which aim to avoid GHG emissions, by co-financing projects to reduce fuel consumption in transport. Key NFEP&WM programmes for electromobility development are shown in the table below.

Table 34. Key NFEP&WM programmes for electromobility development

Name of Programme	Description
'Kangaroo – Safe and green way to school' Programme	The aim of the programme is to provide the opportunity to purchase new electric school buses, train drivers to operate these buses, upgrade or build the infrastructure to charge them.
'eVAN – electric van' Programme	The aim of the programme is to support the purchase of delivery vehicles that use exclusively electric energy for propulsion. The programme provides for the possibility of subsidising projects involving the purchase/leasing of new electric vehicles that use for propulsion only electric energy accumulated by connection to an external power source or the purchase of a charging point with a capacity of less than or equal to 22 kW.
'My electrician' Programme	The aim of the programme is to avoid emissions of air pollutants by co-financing projects that reduce the use of emission fuels in transport through support for the purchase/leasing of zero-emission vehicles. The programme provides for the possibility of co-financing projects involving the purchase of new M1 category vehicles, using for propulsion only electric energy accumulated by connection to an external power source, or electricity generated from hydrogen in fuel cells installed in the vehicle, or only an engine whose duty cycle does not lead to emissions of GHG or other substances.
'Support for electric vehicle charging and hydrogen refuelling infrastructure' Programme	The aim of the programme is to support the development of electric vehicle charging and hydrogen refuelling infrastructure to reduce the number of vehicles emitting CO ₂ and NO _x . Funding can be obtained for the construction or reconstruction of a public charging station with a capacity of no less than 50 kW and less than 150 kW.

Source: study by KOBiZE, IEP-NRI, based on information from NFEP&WM

Methodology for estimating the reduction effect

The methodology for estimating the reduction effect of this measure is based on the assumption that if the measure would not have been implemented, then all electric cars in a given year would have been petrol cars. Therefore, the reduction effect is the avoided emissions equal to the emissions of petrol cars in the number and mileage corresponding to the electric cars in a given year. To calculate the ex-post effect, historical data collected for the development of the emission inventory has been used. The ex-ante effect has not been estimated due to the lack of the necessary data.

Measure 45. Development of vehicles using alternative fuels

Description

Development of vehicles using alternative fuels refers to the implementation of measures such as the development of compressed natural gas (CNG) and liquefied natural gas (LNG) vehicle refuelling infrastructure, the creation of a Register of Alternative Fuel Infrastructure or the introduction of tax preferences for vehicles using alternative fuels. In addition, this measure includes support for innovation in the area of alternative fuels. The main objective is to introduce appropriate instruments to foster the development of the market for vehicles using alternative fuels, including the infrastructure for alternative fuels and the promotion of vehicles using alternative fuels.

Development of infrastructure for refuelling CNG and LNG vehicles

The development of infrastructure for refuelling CNG and LNG vehicles is aimed at providing wider access to charging infrastructure for vehicles using alternative fuels. The General Director for National Roads and Motorways participates with the Ministry of Climate and Environment in the development of a plan for the location of publicly accessible stations, including CNG and LNG refuelling points, necessary to cover the demand for alternative fuels for vehicles travelling on the roads of the TEN-T core network.

Creation of the Register of Alternative Fuel Infrastructure

The creation of the Register of Alternative Fuel Infrastructure, which is a public registry, enables users of electric and natural gas vehicles to obtain information that help them in using these vehicles. The register contains information on the locations of natural gas and publicly accessible charging stations, the current prices of alternative fuels and the availability of charging points installed at publicly accessible charging stations.

Zero excise duty rate

The introduction of tax preferences for alternative fuels used in transport, implies the application of a zero excise duty rate for LNG and CNG, and for biogas, hydrogen and biohydrogen. The zero excise duty rate for biogas and bio-hydrogen will only apply once quality standards for the listed fuels have been established, allowing them to benefit from the zero excise duty rate. On 1 January 2023, the regulation on quality requirements for hydrogen entered into force, making the zero excise duty rate applicable to this fuel.

Methodology for estimating the reduction effect

The methodology for estimating the reduction effect of this measure is based on actual (historical) data, which is the input data to the COPERT programme. The data used to calculate the reduction effect include the number of vehicles (cars and buses), their mileage and their emission factors. Using the aforementioned data, CO₂, CH₄ and N₂O emissions were calculated for each type of vehicle. As the data contain information on CNG vehicles, it was possible to estimate the implementation effect of the measure, which is the development of alternative fuel vehicles.

The methodology used creates a reference scenario which assumes that instead of a certain number of CNG passenger cars and a certain number of CNG city buses, the same number of conventional fuel passenger cars (petrol and diesel) and diesel city buses would be on the road. Using the calculated data on the number of vehicles (with the above assumption) and the same other data used to calculate the emissions of the actual fleet vehicles, a reference scenario was calculated, i.e. a scenario with the assumption that the measure did not occur (i.e. no CNG vehicles). The ex-post reduction effect of the measure was estimated by comparing the reference scenario and the actual data. The ex-ante effect has not been estimated due to the lack of the necessary data.

Measure 46. Promotion of biofuels***Description***

Promotion of biofuels is a measure whose main objective is to introduce a system of incentives and support instruments necessary for the development of the biofuels market in Poland, as well as to support control and a system of quality certification and use of biofuels in road transport. The promotion of biofuels includes a system of incentives for farmers to produce biofuels for their own use, a system for certifying the quality of bio-components and a system for verifying the minimum share of renewable fuel additives or bio-components in liquid fuels or liquid biofuels.

Biofuel incentive system for farmers

The biofuel incentive system for farmers introduces the possibility for farmers to produce liquid biofuels for their own use. This is possible after registration in a dedicated register. A farmer producing liquid biofuels for his/her own use is required to fulfil the following conditions: have at his/her disposal appropriate technical equipment and building facilities that meet certain requirements, hold a permit

to operate a tax warehouse, or produce liquid biofuels for own use outside a tax warehouse with prepayment of excise duty. The registration authority makes an entry into the farmers' register upon written request of the farmer and upon submission of a declaration that the above-mentioned conditions have been fulfilled.

Bio-component quality certification system

A bio-component quality certification system introduces a document, accredited by a certification body, confirming that bio-components placed on the market or used for fuel production meet quality requirements. The bio-component quality certificate includes, in particular, the name of the accredited certification body which issued it, the type of bio-component and the name of the raw materials from which it has been produced. A biocomponent quality certificate is valid for a period of one year from the date of its issue. The accredited certification body may revoke the bio-component quality certificate if the bio-components no longer meet the quality requirements which were the basis for issuing the quality certificate.

Verification system for the minimum share of renewable fuel additives or fuel biocomponents

The system of verification for the minimum share of renewable fuel additives or fuel biocomponents in liquid fuels or liquid biofuels is intended to ensure that the share of biocomponents in the transport fuel market is achieved at the target level. The entity implementing the National Indicative Target is obliged to ensure, in a given calendar year, at least a minimum share of other renewable fuels or biocomponents contained in liquid fuels or liquid biofuels used in all modes of transport. Accordingly, it is possible to carry out a business activity in the production of biocomponents or in the import or intra-Community purchase of biocomponents. The measure allows the performance of a business activity in the marketing of bio-components and liquid biofuels.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 47. Shaping pro-environmental attitudes of drivers

Description

Shaping pro-environmental attitudes in transport is possible through the implementation of measures such as shaping environmentally conscious behaviour of drivers and transport service users, providing consumers with information to make informed choices when buying cars or promoting car sharing.

Shaping environmentally conscious behaviour of drivers and transport service users

The promotion of environmentally conscious behaviour of drivers and transport service users involves the dissemination of environmentally friendly driving techniques as part of the driving learning process e.g., as a compulsory part of driving lessons for amateur and professional drivers. In addition, social campaigns are organised, such as on the occasion of European Mobility Week or World Car Free Day.

Providing consumers with information to make informed choices when purchasing cars

Providing consumers with information to make informed choices when purchasing cars is intended to help consumers to choose vehicles that use less fuel and therefore emit less CO₂. The aim is to ensure that information on the fuel economy and CO₂ emissions of new passenger cars offered for sale or lease in the EU will be available to consumers to enable them to make a choice based on sufficient information.

Promotion of car sharing

The promotion of car sharing is aimed at spreading socially-initiated pro-environmental behaviour by drivers and passengers to reduce the number of vehicles on the road. These initiatives include e.g., offering ad hoc car-pooling (e.g., 'Bla Bla Car', 'WE ARE DRIVING TOGETHER' initiatives) or sharing a means of transport: bicycle (offered by operators e.g., NEXTBIKE, GeoVelo), scooter or car using 'car sharing' system.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 48. Requirements for improving the emission factors of vehicles***Description***

The measure includes the introduction of emission level requirements for vehicles, including in particular a CO₂ emission standard for on-road vehicles, a pollutant emission standard for vehicles and a minimum share of low-emission vehicles in public procurement.

CO₂ emission performance standards for road vehicles

According to the Regulation (EU) 2019/631⁵⁵ of the European Parliament and of the Council of 17 April 2019 setting CO₂ emission performance standards for new passenger cars and for new light commercial vehicles from 1 January 2020, new passenger cars must not emit more than an average of 95 g CO₂/km into the atmosphere and new light commercial vehicles must not emit more than an average of 147 g CO₂/km into the atmosphere.

In 2019, CO₂ emission standards were also set for heavy-duty vehicles with the adoption of Regulation (EU) 2019/1242⁵⁶ of the European Parliament and of the Council of 20 June 2019 setting CO₂ emission performance standards for new heavy-duty vehicles and amending Regulation (EC) No 595/2009 and (EU) 2018/956 of the European Parliament and of the Council and Council Directive 96/53/EC. These standards apply to the four most common categories of heavy-duty vehicles and are set annually to individual automotive manufacturers by the Commission, forcing gradual improvements in the fuel efficiency of vehicles or the conversion of their propulsion systems to alternative fuels.

The aforementioned requirements were revised with adoption of the Regulation (EU) 2023/851⁵⁷ of the European Parliament and of the Council in 2023. New stricter targets were set for new passenger cars and for new light commercial vehicles, including the zero-emission performance of new vehicles from 2035. The 2024 Regulation (EU) 2019/1242⁵⁸ of the European Parliament and of the Council was also revised, introducing new stricter CO₂ reduction targets for heavy-duty vehicles (HDVs), setting

⁵⁵ Regulation (EU) 2019/631 of the European Parliament and of the Council of 17 April 2019 setting CO₂ emission performance standards for new passenger cars and for new light commercial vehicles, and repealing Regulations (EC) No 443/2009 and (EU) No 510/2011 (OJ L 111, 25.04.2019).

⁵⁶ Regulation (EU) 2019/1242 of the European Parliament and of the Council of 20 June 2019 setting CO₂ emission performance standards for new heavy-duty vehicles and amending Regulations (EC) No 595/2009 and (EU) 2018/956 of the European Parliament and of the Council and Council Directive 96/53/EC (OJ L 198, 25.07.2019).

⁵⁷ Regulation (EU) 2023/851 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2019/631 as regards strengthening the CO₂ emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's increased climate ambition (OJ L 110, 25.4.2023).

⁵⁸ Regulation (EU) 2024/1610 of the European Parliament and of the Council of 14 May 2024 amending Regulation (EU) 2019/1242 as regards strengthening the CO₂ emission performance standards for new heavy-duty vehicles and integrating reporting obligations, amending Regulation (EU) 2018/858 and repealing Regulation (EU) 2018/956 (OJ L, 2024/1610, 6.6.2024).

tighter targets for 2030-2034 (45% reduction), 2035—2039 (65% reduction) and from 2040 (90% reduction) and zero-emission of new urban buses from 2030.

Emission standards for vehicles

The application of the Euro classification of standards defining, acceptable emission levels for new passenger cars and light commercial vehicles, trucks, buses, scooters and motorbikes has been in force since the 1990s. This allows emission requirements to be tightened, thereby reducing the environmental impact as well as the fuel costs of new vehicles and strengthening the European automotive industry. Regulation (EC) No. 595/2009 of the European Parliament and of the Council of 18 June 2009 is currently in force in this respect.

In April 2024, a new regulation has been adopted in the EU for the introduction of a new standard, namely Euro 7 for Group M1 and N1 vehicles – Regulation (EU) 2024/1257 of the European Parliament and of the Council⁶⁰. This regulation also lays down rules for type-approval with regard to emissions, production conformity, in-service conformity, market surveillance of on-board monitoring systems, durability of emission control systems and traction batteries, as well as safety provisions to limit tampering and cyber security measures, and rules for the precise determination of CO₂ emissions, electric vehicle range, fuel and electricity consumption, and energy efficiency.

Minimum shares of low-emission vehicles in public procurement

By the Act of 2 December 2021 amending the Act on electromobility and alternative fuels and certain other acts (Journal of Laws, item 2269), which implemented Directive 2019/1161 of the European Parliament and of the Council on the promotion of clean and energy-efficient road transport vehicles, contracting authorities were obliged to ensure minimum target levels for the share of low- and zero-emission vehicles cat. M and N in contracts awarded with a value equal to or greater than the EU thresholds for the supply of vehicles and selected services of a transport nature over two periods: by the end of 2025 and by the end of 2030. The obligation to ensure minimum shares of low- and zero-emission vehicles applies to the following public procurement contracts:

- with a value equal to or greater than the Union thresholds for the purchase, lease, rental or hire-purchase of vehicles;
- with a value equal to or greater than the EU thresholds for the provision of services in the area of public road transport, specialised road passenger transport, non-scheduled passenger transport, transport and delivery of mail or parcels, waste collection;
- with respect to public collective transport with a value exceeding the threshold value concerning the provision of public passenger transport services by rail and by road.

Methodology for estimating the reduction effect

The methodology for estimating the reduction effect of this measure is based on actual (historical) data, which is the input data to the COPERT programme. The data used to calculate the reduction

⁵⁹ Regulation (EC) No 595/2009 of the European Parliament and of the Council of 18 June 2009 on type-approval of motor vehicles and engines with respect to emissions from heavy duty vehicles (Euro VI) and on access to vehicle repair and maintenance information and amending Regulation (EC) No 715/2007 and Directive 2007/46/EC and repealing Directives 80/1269/EEC, 2005/55/EC and 2005/78/EC (OJ L 188, 18.07.2009).

⁶⁰ Regulation (EU) 2024/1257 of the European Parliament and of the Council of 24 April 2024 on type-approval of motor vehicles and engines and of systems, components and separate technical units intended for such vehicles, with respect to their emissions and battery durability (Euro 7), amending Regulation (EU) 2018/858 of the European Parliament and of the Council and repealing Regulations (EC) No 715/2007 and (EC) No 595/2009 of the European Parliament and of the Council, Commission Regulation (EU) No 582/2011, Commission Regulation (EU) 2017/1151, Commission Regulation (EU) 2017/2400 and Commission Implementing Regulation (EU) 2022/1362 (OJ L 2024, 8.5.2024).

effect include the number of vehicles (heavy duty vehicles and buses), their mileage and their emission factors. Using the aforementioned data, CO₂, CH₄ and N₂O emissions were calculated for each type and class of vehicle. As the data contain information on vehicles categorised according to the different Euro standards, it was possible to estimate the effect of implementing the measure of tightening the requirements for improving vehicle emissions.

The methodology used creates a reference scenario, which assumes that instead of a certain number of Euro V and VI trucks and buses, the same number of Euro IV trucks and buses, i.e. older vehicles with higher emissions, would be on the road. Using the same data that was used to calculate the emissions of the actual fleet of vehicles, a reference scenario was calculated, i.e. a scenario assuming that the measure did not occur (i.e. no Euro V and VI trucks and buses are present in the fleet). The ex-post reduction effect of the measure was estimated by comparing the reference scenario and the actual data. The ex-ante effect has not been estimated due to the lack of the necessary data.

Measure 49. Requirements for reduction of the emission factors of fuels in transport

Description

There is a requirement to apply a minimum reduction in GHG emissions over the life cycle of transport fuels as part of the National Reduction Target. Operators engaged in the sustainable divestment of transport fuels (motor petrol, diesel, LPG, CNG, LNG, hydrogen, liquid biofuels) in the country are obliged to demonstrate the reduction. The target is for transport fuels to have at least 6% fewer GHG emissions than the average fuel emissions in the base year (2010). The requirement stems from the provisions of Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998, and to meet it, oil companies can take a number of measures, including financing projects to reduce emissions at the fuel extraction stage (Upstream Emission Reduction), using fuels with higher bio-component content, or marketing low-emission fuels (e.g. LPG, CNG). To ensure that this obligation is properly enforced, there is a system of control over those who meet the target – traders are obliged to report annually on emissions from the fuels they traded in the previous year. Emissions are calculated according to the methodology indicated in the Council Directive (EU) 2015/652 of 20 April 2015 establishing calculation methods and reporting requirements. The reports are verified by the Energy Regulatory Authority, which imposes monetary penalties on the entities if the minimum reduction requirement is not met. To enable obliged entities to meet the requirement, joint adherence to the target is allowed and it is also possible for energy companies selling energy at electric car charging stations to meet the target. The measure contributes to reducing GHG emissions from road transport and to accelerating the transition to low-carbon transport, by incentivising fuel companies to increase the use of bio-components and to increase sales of alternative fuels.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 50. Measures for efficient railway transport

Description

Measures for efficient railway transport support the development of railways and railway infrastructure and provide incentives for the use of railway transport. Efficient development of railway transport is the construction of new and modernisation of existing railway infrastructure (including railway stations), modernisation of rolling stock, expansion of local and regional railway infrastructure,

integration of railway transport with other modes of transport, the Railway Fund (RF), promotion of railway-based public transport.

Construction of new railway infrastructure

Work to build the new railway infrastructure is being carried out in accordance with the provisions of the multi-year programme 'Investment Programme Central Communication Port. Stage I. 2020-2023'. The material scope of the programme envisages e.g., the implementation of Railway Accompanying Investments covering the construction of almost 2000 km of new railway lines, a significant part of them in the High-Speed Rail standard. The effect of the investments carried out under the Programme will be the popularisation of railway transport and the transfer of traffic from road transport, the reduction of traffic exclusion in railway transport and the improvement of regional connections. Most of the planned lines will be built from scratch, so their construction will comply with all applicable safety guidelines, efficiency and environmental requirements. At the pre-design and design stage, the parameters of the new infrastructure will take into account measures to ensure its resilience to climate change.

Modernisation of railway infrastructure

Modernisation of railway infrastructure is implemented in accordance with the National Railway Programme until 2023. On the railway lines, investments are being carried out concerning e.g., the modernisation of railway infrastructure, i.e. lines and junctions and railway stations, which contributes to improving the quality of railway transport. In addition, it focuses on the modernisation of existing and construction of new railway stops in towns and cities through which railway lines run, but where there is no adequate infrastructure for travellers. The measure also aims to support the tasks of railway infrastructure managers, including maintenance and renovation of railway infrastructure.

As a result of the update adopted by the Council of Ministers on 16 August 2023, the name of the programme was changed to the National Railway Programme to 2030 (with an outlook to 2032). Thus, the duration of the programme was adjusted to the EU financial perspective 2021-2027, with some projects planned for implementation until 2032.

Maintenance of railway infrastructure

The process of maintenance and renovation, like the implementation of investment projects, is a tool that contributes to the development of the railway transport sector in Poland. Lack of proper maintenance of the railway infrastructure would threaten the effects of implemented investments, cause premature degradation of modernised railway lines and pose a threat of exclusion from operation of regional railway lines, which enable commuting to work, school, health centres, etc. to inhabitants of localities distant from large agglomerations (from the so-called 'poviat Poland').

The proper maintenance of the railway infrastructure is ensured by the 'Government programme to support the tasks of railway infrastructure managers, including maintenance and renovation, until 2028' establishing the financial framework and conditions for the implementation of the state's intentions in the field of railway infrastructure management. The main effects of the implemented Programme will be:

- ensuring stability of financing of railway infrastructure managers;
- ensuring sustainability of infrastructure investments and long-term utilisation of their effects;
- further elimination of maintenance and repair backlogs.

Modernisation of rolling stock

Modernisation of passenger and freight rolling stock includes adapting rolling stock to the needs of people with disabilities and people with reduced mobility, as well as support for the purchase of locomotives, multiple units and light rail vehicles and wagons.

Expansion of local and regional railway infrastructure

Expansion of local and regional rail infrastructure is intended to supplement the railway network with rail connections for towns with a population of more than 10 000, which do not have access to passenger connections with voivodship cities. The measure also supports the completion of the railway network with rail connections for towns that have access to railways, but the existing connections need to be improved. It is supported by the assumptions contained in the Local and Regional Rail Infrastructure Completion Programme – Rail+ to 2029 (Rail+ Programme) adopted by the Council of Ministers in 2019.

Railway Fund (RF)

The purpose of the Railway Fund (RF) is to collect financial resources for the preparation and implementation of the construction and reconstruction of railway lines, repairs and maintenance of railway lines and liquidation of unused railway lines. The Fund's resources are earmarked for the financing or co-financing by the voivodships of tasks concerning the purchase, modernisation and repair of railway vehicles intended for passenger transport. The beneficiaries of the Fund are managers of railway infrastructure who provide railway carriers with access to this infrastructure.

Integration of railway transport with other modes of transport

Integration of railway transport with other modes of transport is intended to increase the importance of railway transport, primarily due to its high capacity and favourable energy efficiency, low emissions and existing road traffic problems such as lack of parking spaces. Integration is aimed at expanding the railway network as well as modernising the railway infrastructure, i.e. extending stations at key transport hubs such as seaports and airports. In addition, the promotion of rail-based public transport is carried out through the development of public passenger transport (rail, including agglomeration and urban rail) and the integration of other passenger transport or solutions such as Park&Ride. At the same time, the integration of traveller information and tickets from different operators is being carried out (the 'Common Ticket' project).

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 51. Measures for the environmentally friendly development of maritime shipping***Description***

Maritime transport, due to the long voyages of ships, is an important source of fuel consumption and consequently of pollutant and GHG emissions. Due to the transboundary nature of this mode of transport, the main actions aimed at reducing its impact on the environment result from documents and regulations undertaken at international (International Maritime Organisation, IMO) and EU level. The development of maritime transport takes place e.g., by ensuring adequate access to Polish seaports (including dredged and properly maintained waterways), and by monitoring vessel traffic, including the management and supervision of vessel traffic. To this end, appropriate measures are being implemented, i.e. construction of new and improvement of existing infrastructure in Polish

seaports and the implementation of emission standards and innovative technologies in maritime vessel traffic management.

Construction of new and improvement of existing infrastructure in Polish seaports

Construction of new and improvement of existing infrastructure in Polish seaports aims to ensure good access to Polish seaports through e.g., the maintenance and expansion (including dredging) of seaward approach channels and fairways. These measures are needed for investments strictly in port infrastructure, including flagship projects such as the Outer Port in Gdynia and the Container Terminal in Świnoujście. Investments in port and access infrastructure are complementary to each other. Within the framework of the measure, conditions have been created for adapting the infrastructure of selected port terminals to handle intermodal transport and for developing the infrastructure of alternative fuels, including primarily LNG and electricity supply points for ships. In addition, it is important to build and modernise road, rail and river infrastructure connecting ports with the economic hinterland. Implementation of the measure fulfils the assumptions of the 'Programme for the development of Polish seaports until 2030' adopted by the Council of Ministers in 2019.

Implementation of innovative technologies in maritime vessel traffic management

The main objective is the monitoring of vessel traffic, which includes its management and supervision. As a result, a National Vessel Traffic Monitoring and Information System has been established. Efficient vessel traffic management translates into optimised navigation and consequent reduced fuel consumption.

Environmental standards

Increasingly stricter standards are currently being introduced for the emission of pollutants generated by ships from fuel combustion (mainly for SOx and NOx). These standards are being introduced by both the EU (Directive 2012/33/EU) and the IMO (MARPOL Annex VI). Emission levels can be achieved in various ways through e.g., the use of exhaust gas cleaning systems, the use of low sulphur fuels, or by purchasing vessels powered by alternative fuels.

Construction of a waterway linking the Vistula Lagoon with the Gulf of Gdańsk

The construction of a waterway linking the Vistula Lagoon with the Gulf of Gdańsk provides access to the Port of Elbląg via a navigation channel through the Vistula Spit. The realisation of this investment has provided Poland with free access from the Vistula Lagoon to the Baltic Sea, bypassing the Russian-controlled Pilawa Strait. Thanks to this solution, the Elbląg terminal can receive smaller cargoes, relieving the pressure on Tricity ports. The new waterway from the Gulf of Gdańsk through the Vistula Lagoon to Elbląg is a nearly 25 km long section. The official opening of the shipping channel through the Vistula Spit took place in September 2022.

Use of renewable and low-carbon fuels in maritime transport

On 13 September 2023, Regulation (EU) 2023/1805⁶¹ of the European Parliament and of the Council on the use of renewable and low-carbon fuels in maritime transport has been adopted. The regulation lays down uniform rules imposing a limit on the GHG emissions intensity from energy consumption of a ship calling at, berthing in or leaving ports under the jurisdiction of an EU MS and an obligation to use shore-side electricity or to use zero-emission technology in ports under the jurisdiction of an EU MS. The objective of this Regulation is to enhance the consistent use of renewable and low-carbon

⁶¹ Regulation (EU) 2023/1805 of the European Parliament and of the Council of 13 September 2023 on the use of renewable and low-carbon fuels in maritime transport and amending Directive 2009/16/EC (OJ L 234, 22.9.2023).

fuels and substitute energy sources in maritime transport across the EU, in line with the objective of achieving climate neutrality in the EU by 2050 at the latest, while ensuring the smooth operation of maritime transport, regulatory certainty for the uptake of renewable and low-carbon fuels and sustainable technologies and avoiding distortions in the internal market. This Regulation shall apply from 1 January 2025.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 52. Measures for the development of inland waterway transport

Description

For the development of inland waterway transport infrastructure, efforts mainly focus on the development of infrastructure, waterways and harbour and port facilities, as well as the implementation of environmentally oriented solutions.

Implementation of pro-environmental solutions in inland waterway transport

It is assumed that the implementation of the tasks included in the NSP2030 will contribute to the decarbonisation of the fleet, with actions focused on three areas: support for investments in the modernisation of the fleet and the purchase of vessels using alternative fuels and in the construction of low- and zero-emission and energy-efficient fleets; equipping the fleet with systems to increase energy efficiency; and the development of traffic management systems, such as RIS (River Information Services), to increase energy efficiency.

In addition, the introduction of requirements for internal combustion engines used in shipping is aimed at reducing the emissions of gaseous and particulate pollutants from these engines. Manufacturers are required to obtain a type-approval certificate for the engine type before placing engines on the market.

Development of inland waterways

The efficiency of inland waterway transport depends primarily on the stable transit depths of the shipping lane and the availability of locks. Bridge clearances and lock dimensions are of additional importance for its efficiency. The development of inland waterways will contribute to providing conditions for efficient transport in the hinterland of seaports of primary importance to the national economy and will allow a shift of cargo from road transport to low-emission water transport.

The main objective of the NSP2030 is to increase the role of the inland waterway sector nationally and locally and therefore to structurally strengthen inland waterways through investment measures (also point-to-point) to remove bottlenecks and ensure that efficient inland waterway transport is possible.

The effect of the Programme will be e.g., maintaining the possibility of using the waterways through the implementation of investments on the Odra River Waterway and on the Vistula River from the Port of Gdańsk to Toruń. The NSP2030 will also contribute to the development of the entire inland waterway transport sector through measures aimed at shaping conditions for the development of inland terminals, improving environmental protection through lowering the emissions of inland waterway transport vessels and developing traffic management systems. As a result of the Programme, it is also assumed that the human capital of the sector will be developed and that the attractiveness of the waterways and their tourist use will increase.

River Information Services (RIS)

River Information Services are being implemented in the Lower Oder River area to improve the safety of navigation as well as to increase the efficiency of inland waterway transport through the rapid exchange of waterway information on internationally important inland waterway sections. The information provided from RIS can be used to plan journeys and achieve more uniform travel speeds and thus reduce fuel consumption. The aim is to further implement RIS intelligent transport systems on other inland waterways.

The Inland Waterways Fund (IWF) and other initiatives to support the development of inland waterway transport

The Inland Waterways Fund is a support programme for the development and modernisation of inland waterway transport. Strengthened support for shipowners in the modernisation of the fleet is envisaged, made possible by the operation of the Inland Waterways Fund, the aim of which is to subsidise the modernisation of inland waterway transport vessels and inland waterway transport restructuring projects, including measures to improve environmental protection and shipping safety.

It also assumes the development of a research and innovation sector for the use of new technologies, including the construction of environmentally friendly vessels adapted to navigation in the Polish waterways conditions and the development of transport management systems based e.g., on autonomous solutions, as well as the exchange of experience and knowledge transfer and the adaptation of regulations for the introduction of new solutions into the transport market.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 53. Innovative measures for air transport***Description***

The aviation sector is a source of GHG emissions not only at national level, but also as a result of transport between countries. Therefore, measures are being taken both at international (International Civil Aviation Organisation, ICAO) and EU level, as well as at national level, to reduce the climate impact of the sector. Innovative actions for air transport are aimed at improving airport infrastructure, implementing modern air traffic solutions, as well as improving the operational efficiency of air transport, including the reduction of harmful emissions. The aviation sector is also covered by the EU ETS (Measure 1).

Improving airport infrastructure

The aim is to adapt airport infrastructure to handle the increasing number of passengers and air operations and to improve the connection of regional airports with the road and railway transport network, in particular with city centres via public transport and national transport hubs – within the framework of TEN-T membership. An example of this measure implementation is the construction of the Central Communication Port. This measure assumes the construction of a transport hub, based on integrated nodes: air and rail, and effectively integrated into the road network system.

Implementing modern air traffic solutions

The sustainable development of the air transport market in Poland in the long term is fostered by the participation of national entities in developing and implementing modern air traffic management systems carried out under the Single European Sky ATM Research (SESAR) programme. Timely, coordinated and synchronised implementation of the new system will enable the capacity of the ATM

(Air Traffic Management) network to be increased, while maintaining a high level of safety and reducing costs, to cope with the growing number of air operations while improving safety indicators.

Improving the operational efficiency of air transport

An innovative measure that improves air transport is the improvement of its operational efficiency. This occurs through the systematic modernisation of the fleet, which allows fuel savings and a significant reduction of CO₂ emissions. In addition, the measure contributes to the optimisation of air corridors, increases airspace capacity and increases the capacity of taxiways, which reduces fuel consumption and CO₂ emissions.

Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)

In October 2016, ICAO adopted a resolution to establish a global market-based measure (CORSIA) to address the challenges of reducing CO₂ emissions from the international aviation sector. The adopted resolution defined the main objectives and key assumptions on which this measure shall be based and set out a work programme for its operationalisation. The market-based measure identified in the resolution is CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation), a scheme to offset emissions from international aviation. The main objective of the mechanism is to maintain zero incremental CO₂ emissions in civil international aviation from 2021 onwards, relative to 2019-2020 emissions. CO₂ offsetting and reduction obligations apply from 2021 onwards, but the first obligations on the part of air carriers and states already took place in 2019 and included emissions monitoring. According to the adopted solutions, the participants in the mechanism will be air operators carrying out international transport using aircraft with MTOW > 5,700 kg, emitting more than 10,000 t of CO₂ per year, excluding humanitarian, medical and firefighting flights.

Dissemination of sustainable aviation fuels

On 18 October 2023, Regulation (EU) 2023/2405⁶² of the European Parliament and of the Council (ReFuelEU Aviation) laying down harmonised rules for the use and supply of sustainable aviation fuels (hereinafter 'SAF') has been adopted. It introduces a number of solutions regarding the share of SAF available at EU airports, the obligations of aircraft operators to refuel sustainable fuel, the obligations of the EU airport managing body to facilitate access to SAF or the reporting obligations of covered entities. In addition, ReFuelEU Aviation provides for the introduction of a voluntary eco-labelling scheme to measure the environmental performance of flights. The regulation applies from 1 January 2024, but the SAF obligation arises from the beginning of 2025.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

4.2.4. Industrial processes (IPPU)

Key strategic documents and regulations

The following tables summarise the key national policy documents and regulations for the industrial processes sector, affecting its operation and conditioning environmental and climate protection.

⁶² Regulation (EU) 2023/2405 of the European Parliament and of the Council of 18 October 2023 on ensuring a level playing field for sustainable air transport (ReFuelEU Aviation) (OJ L 2405, 31.10.2023).

Table 35. Key strategic documents in the industrial processes sector

Document title	Document description
Productivity Strategy 2030 adopted by the Council of Ministers on 12 July 2022	The Productivity Strategy 2030 aims to ensure productivity growth based on the use of knowledge and new technologies, especially digital ones. It is one of the 9 strategies integrated with the Strategy for Responsible Development and constitutes its extension in the economic area. It updates, complements and develops the Strategy for Innovation and Efficiency of the Economy 'Dynamic Poland 2020', which was in force until 2020. The document sets out the objectives and directions of state intervention in the area of industrial policy, innovation policy or export policy. It also provides the basis for the disbursement of funds from the European Funds in the perspective of the period 2021–2027.
	Other documents concerning the industry sector are described in Chapter 4.2.1. discussing cross-sectoral measures and in Chapter 4.2.2. concerning the energy sector (energy consumption).

Source: study by KOBiZE, IEP-NRI

Table 36. Key regulations in the industrial processes sector

Document title	Document description
The Act implements the provisions of the Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006 (OJ L 150, 20.05.2014, as amended) and the Regulation (EC) No 1005/2009 of the European Parliament and of the Council of 16 September 2009 on substances that deplete the ozone layer (OJ L 286, 31.10.2009, as amended)	It sets out i.e. the obligations of operators in the field of production and services related to the use of ozone-depleting substances or fluorinated GHGs, the tasks for authorities in this respect and sanctions for violations.
	Other documents concerning the industry sector are described in Chapter 4.2.1. discussing cross-sectoral measures and in Chapter 4.2.2. concerning the energy sector (energy consumption).

Source: study by KOBiZE, IEP-NRI

Policies and measures

Measure 54. Limitation of the use of fluorinated GHGs

Description

A group of measures aimed at reducing emissions of fluorinated GHGs (i.e. HFCs, PFCs, SF₆) under the Regulation 517/2014 of the European Parliament and of the Council⁶³, by phasing out ozone-depleting substances (ODSs) and limiting the availability and use of fluorinated refrigerants.

The main elements of the above measures specify:

- obligations for operators from the manufacturing and service industries related to the use of ODS and fluorinated GHGs (e.g., to restrict the placing on the market of HFCs in bulk and contained in equipment);

⁶³ Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006 (OJ L 150, 20.05.2014, as amended).

- sanctions for infringements of the provisions on ODS and fluorinated GHGs and on products, equipment, fire protection systems and fire extinguishers as well as air conditioning systems in certain motor vehicles containing these agents;
- a certification system for persons and companies carrying out certain activities in the area of fluorinated GHGs and ODSs;
- an obligation to maintain electronic records for equipment and systems in the Central Operator Register and an annual electronic reporting obligation in the Reports Database.

Action has also been taken, under Directive 2006/40/EC⁶⁴ and the national legislation implementing it, to restrict the placing on the market of passenger vehicles fitted with air-conditioning systems containing F-gases with a GWP of 150 or more.

Methodology for estimating the reduction effect

The methodology for estimating the reduction effect of this measure is based on an expert estimate of the future (ex-ante) reduction in emissions of fluorinated GHGs (presented in the form of CO₂ equivalents), developed based on knowledge of the facts represented by the national balance of F-gases used in industry and the introduction of appropriate assumptions as to the reduction measures to be taken under the relevant legislation. In the case of the use of equipment (e.g., air conditioning), the different stages of the product life cycle were taken into account, i.e. import of the equipment (or refrigerant), the normal use cycle including maintenance and decommissioning. In the case of commercial trade in F-gases and the use of F-gases for maintenance of equipment, legal provisions for restrictions or cessation of specific chemical use were taken into account. No data are available to estimate the ex-post reduction effect.

Measure 55. Further tightening of requirements to limit the use of fluorinated GHGs

Description

Regulation (EU) No 2024/573⁶⁵ of the European Parliament and of the Council introduced enhanced requirements for the reduction of F-gases. It aims to ensure that additional reductions of F-gases are achieved to consequently contribute to the achievement of 55% GHG emission reductions by 2030 and net GHG emission neutrality by 2050 in the EU, to be achieved primarily through tightening requirements for HFCs. In addition to maintaining the measures outlined in Measure 54 resulting from the implementation of Regulation 517/2014, bans have been introduced related to:

- using FGCs with a GWP of 2,500 or more for the maintenance or servicing of air conditioning equipment and heat pumps (from 1.1.2026);
- using FGC with a GWP of 750 or more for the maintenance or servicing of stationary refrigeration equipment, excluding chillers (from 1.1.2032);
- using SF₆ for the maintenance or servicing of electrical switchgear unless this gas is reclaimed or recycled, unless reclaimed or recycled SF₆ is demonstrated (from 1.01.2035);
- using FGC maintenance or servicing of electrical switchgear.

⁶⁴ Directive 2006/40/EC of the European Parliament and of the Council of 17 May 2006 relating to emissions from air conditioning systems in motor vehicles and amending Council Directive 70/156/EEC (OJ L 161, 14.6.2006).

⁶⁵ Regulation (EU) 2024/573 of the European Parliament and of the Council of 7 February 2024 on fluorinated greenhouse gases, amending Directive (EU) 2019/1937 and repealing Regulation (EU) No 517/2014 (OJ L 2024/573, 20.02.2024).

In addition, Regulation 2024/573 tightens the timetable for HFC marketing reductions, introduces EUR 3/t CO₂ eq for quotas on HFC imports from outside the EU and introduces an obligation for EU MS to maintain an electronic HFC emissions database.

Methodology for estimating the reduction effect

The methodology for estimating the reduction effect of this measure is based on an expert estimate of the future (ex-ante) reduction in emissions of fluorinated GHGs (presented in the form of CO₂ equivalents), developed based on knowledge of the facts represented by the national balance of F-gases used in industry and the introduction of appropriate assumptions as to the reduction measures to be taken under the relevant legislation. In the case of the use of equipment (e.g., air conditioning), the different stages of the product life cycle were taken into account, i.e. import of the equipment (or refrigerant), the normal use cycle including maintenance and decommissioning. In the case of commercial trade in F-gases and their use for maintenance of equipment, legal provisions for restrictions or cessation of specific chemical use were taken into account. No data are available to estimate the ex-post reduction effect.

Other measures affecting GHG emissions from the industrial processes sector are described in section 4.2.1 discussing cross-sectoral measures and in section 4.2.2 on the energy sector.

4.2.5. Agriculture

Key strategic documents and regulations

The following tables summarise the key national policy documents and regulations for the agriculture sector, affecting its operation and conditioning environmental and climate protection.

Table 37. Key strategic documents in the agriculture sector

Document title	Document description
Action programme to reduce water pollution from nitrates used for agricultural purposes and prevent any further pollution adopted by the Council of Ministers on 31 January 2023	The action programme obliges all farmers who carry out agricultural production, including specialised departments of agricultural production, and activities where fertilisers are stored, to manage such production in a way that prevents and reduces the pollution of water by nitrates from agricultural sources. The new updated action programme is effective from 8 February 2023 and was developed after a comprehensive review in 2022 of the existing 2018 action programme.
Framework Action Plan for Organic Food and Farming in Poland for 2021–2030 – updated on 30.11. 2022	A document prepared by the Minister of Agriculture and Rural Development, in line with the requirements of the European Green Deal. The aim of the Plan is to develop organic production, including the growth of the market for organic products in Poland, and to allocate at least 7% of agricultural land under the organic production system by 2030. Support for the organic farming sector is planned for all participants in the food chain 'from farm to fork'.
Strategic Plan for the Common Agricultural Policy for 2023-2027, approved by the European Commission on 31 August 2022	The Strategic Plan for the Common Agricultural Policy for 2023-2027 supports the sustainable development of Polish farms, the processing sector and the improvement of living and working conditions in small villages. The CAP also supports sustainable farming methods that are climate and environmentally friendly, protecting water, soil and air, and biodiversity. The plan includes interventions to encourage farmers to apply higher standards in agricultural production, environmentally friendly production methods, reducing GHG emissions, improving soil quality, increasing water retention.
Strategy for Sustainable Rural, Agricultural and Fisheries Development 2030 adopted by the Council of Ministers on 17 October 2023	The Strategy for Sustainable Rural, Agricultural and Fisheries Development 2030 is a document setting out the basic conditions, national objectives and directions of development, designed for the agri-food sector and rural areas with a view to ensuring food security for all Poles. The planned directions of intervention until 2030 envisage e.g., building the resilience of agricultural and fisheries production, including resilience to climate change, sustainable management and protection of environmental resources, and adaptation to and counteracting climate change.

Document title	Document description
Rural Development Programme (RDP) 2014-2020 approved on 12 December 2014 by the European Commission	The programme defines the objectives, priorities and principles for supporting rural development with resources from the European Agricultural Fund for Rural Development (EAFRD), pursuant to the Regulation (EU) No 1305/2013 of the European Parliament and of the Council of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No 1698/2005. The most important objective of the programme is to increase the competitiveness of agriculture taking into account environmental objectives. The RDP 2014—2020 is based on the implementation of six priorities, two of which are directly related to the environment and climate protection, i.e. protection of ecosystems and efficient management of natural resources.

Source: study by KOBIZE, IEP-NRI

Table 38. Key regulations in the agriculture sector

Document title	Document description
Act of 13 July 2023 on facilitations of the preparation and realisation of investments in agricultural biogas plants and their operation (Journal of Laws of 2023, item 1597)	The Act sets out specific rules and procedures for the preparation and realisation of agricultural biogas plants and rules of procedure for the issuing a decision on the construction permit for agricultural biogas plants, aimed at facilitating and speeding up the preparation and realisation of investments in agricultural biogas plants, as well as the conditions for the performance of activities in these biogas plants.
Regulation of the Minister of Agriculture and Rural Development of 17 April 2023 on the detailed conditions and detailed procedure for granting and paying organic payments under the Strategic Plan for the Common Agricultural Policy for 2023-2027 (Journal of Laws of 2023, item 791, as amended)	The Regulation sets out the detailed conditions and detailed procedure for the granting and payment of organic payments, known as 'organic payments', including: the detailed requirements to be met by applications for organic payments, the detailed conditions and procedure for granting organic payments to a successor in title of an applicant for these payments or to a transferee of land, the level of penalties and the manner of their calculation and the rates of organic payments.
Act of 8 February 2023 on the Strategic Plan for the Common Agricultural Policy for 2023-2027 (Journal of Laws of 2024, item 261, as amended)	The Act sets out the tasks and competence of the authorities and organisational units in the scope concerning the implementation of the Strategic Plan for the Common Agricultural Policy for 2023-2027, as well as the conditions, procedure and payment of financial assistance under the interventions covered by the Plan, as well as technical assistance.
Act of 23 June 2022 on organic farming and organic production (Journal of Laws of 2023, item 1235)	The Act defines the tasks and competence of the authorities and organisational units in the field of organic production as defined in the Regulation (EU) 2018/848 of the European Parliament and of the Council, as well as matters concerning the performance of official controls and other official activities and conditions for organic production.
Act of 20 July 2017 on Water law (Journal of Laws of 2024, item 1087, as amended)	The Act regulates the management of water in accordance with the principle of sustainable development, in particular the shaping and protection of water resources, the use of water and the management of water resources. To protect waters from pollution by nitrates from agricultural sources, it introduced the obligation to develop an action programme with the primary objective of reducing water pollution caused by fertilisation of agricultural land with manure and a set of recommendations for good agricultural practice.
Act of 20 February 2015 on support for rural development with the participation of the European Agricultural	The Act sets out the tasks and competence of the authorities and organisational units with regard to supporting rural development using funds from the European Agricultural Fund for Rural Development under the Rural Development Programme 2014-2020 and the conditions and procedure for granting, paying and repaying such financial assistance.

Document title	Document description
Fund for Rural Development under the Rural Development Programme 2014-2020 (Journal of Laws of 2023, item 2298)	
Act of 10 July 2007 on fertilisers and fertilisation (Journal of Laws of 2024, item 105)	Among other things, the Act regulates matters relating to the marketing and use of fertilisers, the prevention of risks to humans, animals and the environment that may arise from the transportation, storage and use of fertilisers, and agrochemical services for agriculture.
Act of 7 March 2007 on support for rural development with the participation of the European Agricultural Fund for Rural Development under the Rural Development Programme 2007-2013 (Journal of Laws of 2023, item 1105)	The Act sets out the tasks and competence of the authorities and organisational units with regard to supporting rural development using funds from the European Agricultural Fund for Rural Development under the Rural Development Programme and the conditions and procedure for granting, paying and repaying such financial assistance.
Act of 21 December 2000 on the commercial quality of agri-food products (Journal of Laws of 2023, item 1980)	The Act regulates matters of commercial quality of agri-food products and the organisation and principles of operation of the Inspection of the Commercial Quality of Agricultural and Food Products.
Act of 3 February 1995 on the protection of agricultural and forest land (Journal of Laws of 2024, item 82)	The Act sets out rules for the protection of agricultural and forest land and the rehabilitation and improvement of the use value of land.

Source: study by KOBiZE, IEP-NRI

Policies and measures

Measure 56. Reduction of the environmental and climate impact of agriculture supported under Pillar I of the CAP

Description

This measure covers environmental and climate mitigation issues supported under Pillar I of the Common Agricultural Policy (CAP). Currently, these are mainly conditionality and eco-schemes, implemented under the Strategic Plan for the CAP for 2023—2027.

Conditionality

Conditionality are standards aimed at proper soil management, prevention of soil erosion, as well as agricultural water management and water protection. Compliance with these standards is mandatory for a farmer applying for e.g., direct payments. The conditionality system is made up using statutory management requirements (SMRs) and good agricultural and environmental condition (GAEC) standards, which are more relevant in the context of climate protection.

GAEC standards cover issues such as:

- maintenance of permanent grassland based on the proportion of permanent grassland area to agricultural land (AL) at national level;

- protection of wetlands and peatlands;
- prohibition of burning of agricultural land;
- establishment of buffer strips along watercourses;
- ploughing management that contributes to reducing the risk of soil degradation and erosion, including consideration of slope;
- minimum soil cover during the most sensitive periods (from the day of harvest of the main crop to 15 October of the year in question, with a possible interruption of no more than four weeks for agronomic treatment before sowing winter crops; in the inter-rows in fruit tree plantations at least from 1 November of the year in question to 15 February of the following year);
- crop rotation and diversification on arable land;
- preservation of landscape features, a ban on pruning hedges and trees during the breeding and rearing season of birds;
- a ban on conversion or ploughing of permanent grassland designated as valuable in Natura 2000 sites.

Eco-schemes

A new form of support for farmers – so-called ‘eco-schemes’ – is included in the Strategic Plan for the CAP for 2023–2027. EU MS are obliged to allocate at least 25% of direct payments to this instrument.

Eco-schemes are an annual payment for the implementation of voluntary commitments or practices that are beneficial to the environment, climate and animal welfare. Actions eligible for eco-schemes go beyond the baseline requirements set out in conditionality. The instrument is designed to realise environmental benefits to the greatest extent possible, while encouraging farmers to actively engage in the implementation of environmental and climate protection measures. Eco-schemes affecting GHG emissions include:

- *Eco-scheme ‘carbon farming and nutrient management’* comprising 8 practices, i.e.: Extensive use of permanent grassland with livestock stocking rates, winter intercrops/undersawns, development and observance of a fertilisation plan – baseline and liming variant, diversified cropping structure, mixing of manure on arable land within 12 hours of application, application of liquid manures by methods other than splash, simplified cropping systems and mixing of straw with soil. This eco-scheme is implemented based on a points system, where 1 point obtained for each practice applied will correspond to approximately PLN 100.
- *Eco-scheme ‘water retention on permanent grassland’*, which aims to promote water retention that improves water management and also reduces carbon dioxide emissions to the atmosphere (by reducing decomposition of organic matter). The payment is granted to farmers who make their permanent grassland available for water retention purposes, located in areas where flash floods and flooding actually occurred during the growing season in a given year. The implementation of this eco-scheme will be based on satellite monitoring. This intervention provides an opportunity to compensate for possible losses caused by flooding/flash floods on permanent grassland.
- *Eco-scheme ‘land taken out of production’*, which states that from 2024 onwards, farmers implementing this eco-scheme will receive a payment for voluntarily taking arable land out of production. The payment is granted up to an area of no more than 4% of the farm's arable land. The estimated payment rate is approximately EUR 126.52/ha, i.e. about PLN 563/ha. On land excluded from production there is a ban on agricultural production until 31 July (including a ban on grazing and mowing) and a ban on the use of plant protection products. From 2025 the ‘Eco-scheme ‘land taken out of production’ has been extended to include fallow land on which

established landscape elements are located, including hedgerows or strips of wooded land, linear planted trees, single trees, mid-field coppices, ditches, ponds, mid-field balks or buffer zones. Areas taken out of production, including areas where new landscape elements have been created, have a beneficial effect on the environment, in particular on the biodiversity of agricultural areas. This intervention will also contribute to reducing the use of pesticides by prohibiting their use.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 57. Reduction of the impact of agriculture on the environment and the climate supported under Pillar II of the CAP (rural development policy)

Description

The agricultural sector can reduce its environmental and climate impacts through changes in its livestock production, improved manure management, increased use of renewable energy, and improved energy efficiency of farm buildings. Such measures are supported by the RDP 2014—2020, as well as the Strategic Plan for the CAP for 2023—2027.

LFA payments

These are payments available to farmers farming in mountainous or other less-favoured areas (LFAs). The minimum area of an agricultural plot declared for LFA payments is 0.1 ha and the minimum area of agricultural land located in LFAs is 1 ha (maximum 75 ha). They are intended for active farmers who carry out agricultural activities in designated LFA areas. These payments are intended to compensate farmers for all or part of the additional costs and lost income associated with the restrictions on agricultural production in LFA areas, making it easier for farmers to continue agricultural use of the land. The implementation of this intervention is also intended to enable the preservation of the landscape values of rural areas and the maintenance and promotion of sustainable farming systems in these areas. As a result, this support will have a positive impact on maintaining the vitality of rural areas and will preserve biodiversity.

Support includes the following sub-measures:

- payments for areas, other than mountain areas, facing significant natural constraints (LFAs with natural constraints);
- payments to other areas facing specific constraints (LFA specific type);
- payments to mountain areas (LFA mountain type).

Agri-environmental-climate interventions (commitments)

A group of interventions involving the use of subsidies to compensate for additional costs incurred and lost income for farmers who voluntarily adopt production methods to preserve biodiversity, landscape and environmental resources. Key practices promoted under agri-environment-climate interventions include extensification of agricultural use of meadows and pastures (including in Natura 2000 sites), preservation of old traditional orchards, conservation of biodiversity on arable land, organic farming.

On-farm investment in RES and improvement of energy efficiency

This intervention is aimed at reducing the pressure of agricultural activity on the environment, through the use of energy from renewable sources, the proper management of waste and by-products from agriculture and improving energy efficiency. The investments in energy generation installations will serve exclusively to meet the beneficiary's own energy needs and the production capacity of these

installations will not exceed the equivalent of the combined average annual consumption of thermal and electrical energy on the farm. This intervention supports tangible or intangible investments in particular concerning the construction or purchase of:

- new facilities for the production of energy from agricultural biogas (electricity or heat or gaseous fuel) up to 50 kW with the possibility of installing energy storage;
- solar thermal energy production facilities up to 50 kW with energy storage and energy management systems or heat pumps;
- systems improving the energy efficiency of farm buildings used for agricultural production, such as the construction, conversion or purchase of biomass boilers, heat recovery systems, roof glazing, LED lighting, and thermo-modernisation of farm buildings used for agricultural production.

Investments contributing to environmental and climate protection

The aim of this intervention is to protect natural resources and the climate through investment support. This will enable farms to meet the technical conditions for reducing the pressure of agriculture on the environment. The aid consists of subsidising investments aimed e.g. at reducing the use of plant protection products or fertilisers, reducing pollutant emissions, including GHG, ammonia and odours, increasing soil sequestration and biodiversity through appropriate land use, adapting to climate change, including improved water management on the farm.

Investments to protect waters against pollution caused by nitrates from agricultural sources

The aim of this measure is to protect waters from pollution by nitrates from agricultural sources by bringing the farm into line with the requirements set out in the 'Programme of measures to reduce pollution of waters by nitrates from agricultural sources and to prevent further pollution', concerning the storage conditions for manure or silage produced on the farm, or retrofitting the farm with equipment to apply manure directly to the soil. Support is provided for the retrofitting of farms with slabs or tanks for the storage of natural fertilisers and silage, as well as the purchase of machinery and equipment for the soil application by liquid natural fertilisers.

Modernisation of agricultural holdings

Support is provided for investment measures that will contribute to improving the overall performance of the farm. The improvement of the overall performance of an agricultural holding shall be understood as improving the competitiveness and increasing the profitability of the agricultural holding. Preference is given to e.g., investments to protect the environment or prevent climate change and investment measures for production in quality systems, including the EU quality system for organic farming. In addition, one of the areas of support is for operations involving the construction of renewable energy sources – investments in solar energy installations with energy storage and intelligent energy management systems with the possibility of installing heat pumps.

Restructuring of small farms

Restructuring of small farms applies to farms with an economic size of less than EUR 13,000. Restructuring is understood as fundamental changes to a holding which are intended to improve its competitiveness and increase its profitability by increasing the economic size of the holding, in particular by changing the profile of agricultural production conducted there. Additional points when determining the order in which aid will be granted may be awarded to applications for aid which include investments set out on a list of types of investment that serve to protect the environment or

prevent climate change. These investments include e.g., retrofitting farms with slurry or manure tanks, manure slabs with side walls and a slurry tank, ventilation systems with air filters.

Bonuses for young farmers

The support relates to the commencement and development of agricultural activity on a farm, as well as preparation for the sale of agricultural products produced on the farm. According to the current legislation, persons who are under 40 years of age, have the relevant professional qualifications and are setting up for the first time on an agricultural holding as the sole head of such holding may apply for support. Applications containing investments related to environmental and climate protection may receive additional points when determining the order in which aid will be granted.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 58. Organic farming

Description

Production on the organic farm shall be carried out in accordance with the principles of sustainable development, shall activate biological processes through the use of natural inputs and shall ensure the continued fertility of the soil and the health of plants and animals. In particular, this production involves the use of correct crop rotation and other natural methods to maintain or enhance biological activity and soil fertility, as well as the selection of plant species and varieties and animal species and breeds, taking into account their natural resistance to disease. In 2022, the Framework Action Plan for Organic Food and Farming in Poland for 2021—2030 has been updated.

Support for organic farming is available in RDP 2014—2020, under the measure 'Organic Farming' up to and including 2024. The availability of the aforementioned measure is due to the ongoing transitional period needed for the implementation of specific measures or commitments under RDP 2014—2020 – in relation to the launch year of the Strategic Plan. In addition, the Ministry of Agriculture and Rural Development has introduced other support mechanisms under RDP 2014—2020 containing preferential rules in granting aid for operations concerning organic farming, i.e. concerning measures entitled 'Development of holdings and economic activities', 'Investments in fixed assets', 'Quality schemes for agricultural products and foodstuffs', 'Establishment of producer groups and organisations'. From 2019 onwards, with the help of increased payment rates for agricultural land in organic farming in connection with the EU target to increase the area of such land in the EU, a renewed increase in the area of agricultural land in the organic farming system has been observed. In doing so, it should be noted that the vast majority of the aforementioned agricultural land is covered by organic payments under the CAP.

From 2023 onwards, the Strategic Plan for the CAP for 2023—2027 is under implementation, which includes the continuation of financial support for farmers up to an area of agricultural land under organic farming within the intervention – Organic Farming. This support continues to apply to both the maintenance of organic farming practices after the conversion period and also during the conversion period, i.e. the time required to convert from non-organic to organic production, during which organic production rules apply. The Strategic Plan also provides for other interventions to support the development of organic production.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 59. Rational use of fertilisers***Description***

The rational use of fertilisers includes the Nitrate Programme, the ban on the use of granular urea with the exception of the use of granular urea containing either a urease inhibitor or a biodegradable coating, and the Soil Regeneration Programme. These measures are implemented based on legal regulations (Act on Water Law, Act on Fertilisers and Fertilisation, Act on State Plant Health and Seed Inspection Service (SPHSIS)).

Nitrate programme

The minister in charge of water management has been obliged by the Act of 20 July 2017 on Water Law to develop an action programme whose primary objective is to reduce pollution of waters by nitrates from agricultural sources caused i.e. by fertilising agricultural land using fertilisers containing nitrogen in their composition and to prevent further pollution of this kind. Accordingly, the first 'Action programme to reduce water pollution from nitrates used for agricultural purposes and prevent any further pollution' (the so-called Nitrate Programme) was adopted in 2017 and has already been revised several times. A new, updated has entered into force in February 2023. The most important measures identified in the Programme include:

- establishing conditions for the agricultural use of nitrogen fertilisers near water, on steeply sloping areas, and on frozen, flooded or snow-covered soils;
- introducing periods during which the agricultural use of fertilisers is permitted;
- specifying the conditions for storing manure and handling leachate;
- determining the calculation method for the annual application rate of natural fertilisers containing no more than 170 kg N/ha;
- introducing an obligation to draw up a plant-specific nitrogen fertilisation plan.

In particular, the changes introduced concern:

- applying a flexible spring timing for fertilisation;
- updating of manure production rates and nitrogen content;
- calculation of maximum nitrogen fertiliser application rates;
- adding fertiliser equivalents for wastewater intended for agricultural use and municipal sewage sludge.

All farms are required to comply with:

- an acceptable application rate for natural fertilisers of no more than 170 kg of nitrogen in pure component per hectare of agricultural land per year;
- mandatory distances from water bodies;
- fertilisation dates;
- storage of natural fertilisers;
- maintenance of documentation related to the implementation of the Action Programme.

Medium and large farms have additional responsibilities, such as keeping records of agrotechnical treatments related to nitrogen fertilisation and developing a nitrogen fertilisation plan.

Ban on the use of urea in granular form without a urease inhibitor or without a biodegradable coating

In 2020, a ban on the use of urea in granular form without a urease inhibitor or without a biodegradable coating was introduced by an amendment to the Act on Fertilisers and Fertilisation and the Act on

State Plant Health and Seed Inspection Service (SPHSIS). This ban is effective from 1 August 2021. This solution contributes to increased fertiliser efficiency and air protection.

Soil regeneration programme

Soil liming treatment is an important factor shaping the quality and safety of the natural environment against the background of specific soil and climate conditions. From 2019 to 2023, the NFEP&WM ran the 'National Programme for Environmental Regeneration of Soils through Liming', aimed at supporting regeneration measures for soils acidified by anthropogenic factors. Subsidies for soil liming were of great interest to farmers. This has translated not only into the number of applications submitted, but also into an increase in the use of lime fertilisers. Currently, work is underway to continue the programme, including the reallocation of funds for better meeting demands of individual voivodships.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 60. Scientific and educational projects for rational and low-emission agricultural production

Description

A number of research projects and educational activities aimed at developing rational and low-carbon agricultural production are currently underway in Poland. The key ones are presented below.

AgroFossilFree – Fossil-energy-free agriculture

The aim of the AgroFossilFree project is to establish a framework for a pathway to emission-free agriculture in the EU by reducing fossil fuel energy consumption, using energy more efficiently, optimising agricultural production, reducing GHG emissions and increasing economic, agronomic and environmental benefits. The project is based on a 'multi-stakeholder approach', involving a consortium of scientists and researchers, extension service providers, farmers' organisations and industrial partners. On behalf of Poland, the project involves the Institute of Soil Science and Plant Cultivation – National Research Institute in Puławy and the Lublin Agricultural Advisory Centre in Końskowola. The project is funded by the EU's Horizon 2020 programme.

EJP SOIL – Towards climate-smart sustainable management of agricultural soils European Joint Programme

The main objective of the EJP SOIL project is to build a sustainable, integrated European research system for agricultural soils and to develop and implement rules for the climate-smart sustainable management of agricultural soils. The realisation of this objective will contribute to creating the right conditions for highlighting the role of agricultural soils in key societal challenges such as:

- a) food and water safety,
- b) sustainable agricultural production,
- c) adaptation of agriculture to and mitigation of climate change,
- d) the provision of ecosystem services by soils,
- e) biodiversity conservation,
- f) human health.

The project involves 26 institutions from 24 European countries and is funded by the EU's Horizon 2020 programme.

State Agricultural Advisory Centres

The agricultural advisory units operating in Poland (16 voivodship agricultural advisory centres (AAC) and the Agricultural Advisory Centre) carry out a wide range of advisory, training and dissemination activities for agriculture, including measures concerning the reduction of GHG emissions into the environment.

According to the approved in 2023 annual action programmes, the AAC under the Ministry of Agriculture and Rural Development's designated priority line of advisory activity '4. Adaptation to climate change and protection of water, soil and air (taking into account the requirements of the Water Framework Directive, Nitrates Directive, NEC Directive, current Green Deal initiatives)':

- 4f) good agricultural practices to reduce ammonia emissions to air;
- 4g) good practices for GHG reduction;

conducted training and information activities and provided advisory services, mainly aimed at farmers. The scope of the trainings included such topics/areas as: renewable energy sources, nitrogen fertilisation (update of the nitrogen programme), on-farm environmental protection activities, soil protection and regeneration or the farmer's obligations under the Act on Water Law (protection of waters from pollution).

Network for Innovation in Agriculture and Rural Areas (NIA)

This network operates within the Polish Rural Network and is open in nature. The structure of the NIA is based on public agricultural advice. NIA supports innovation in agriculture, food production, forestry and rural areas. Its main purpose is to:

- facilitate the establishment and operation of networks between farmers, advisory bodies, scientific entities, agri-food entrepreneurs and other entities supporting the implementation of innovation in agriculture and rural areas;
- facilitate the exchange of expertise and good practice in innovation in agriculture and rural areas;
- assist in the setting up of European Innovation Partnership Operational Groups and assist in the development of projects by Operational Groups and innovation partnerships.

Partners in the network may include all actors involved in the development of agriculture and rural areas, including in particular scientific bodies, entrepreneurs, farmers, farmers' organisations, branch organisations.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 61. Development of agricultural biogas plants***Description***

Energy generation in agricultural biogas plants contributes to reducing the problem of landfilling agricultural waste, while at the same time reducing atmospheric emissions of methane, which comes from the fermentation of freely stored biomass. The processing of organic substances may also provide a source of valuable fertiliser for agriculture. Pursuant to the Act on Renewable Energy Sources, the business activity of producing agricultural biogas or electricity from agricultural biogas in an installation other than a micro-installation is a regulated activity within the meaning of the Act – Entrepreneurs' Law and requires an entry in the register of agricultural biogas producers. As of June 2024, the register

of agricultural biogas producers in Poland includes 167 agricultural biogas plants with a total installed capacity of 155.5 MW, owned by 139 operators.

Support for the development of agricultural biogas plants

In September 2023, the Act on Facilitation of the Preparation and Implementation of Investments in Agricultural Biogas Plants and their Operation came into force. It regulates the following issues:

- speeding up the process of constructing an agricultural biogas plant;
- facilitating the issue of conditions for connecting an agricultural biogas plant to the grid;
- exempting from the obligation to change the use of land and its exclusion for agricultural biogas plants located on farms with an area of no more than 1 ha;
- allowing the location of an agricultural biogas plant on land belonging to an agri-food processing plant, if the provisions of the local spatial development plan provide for the possibility of locating a development related to agriculture or production, or services, or storage, and the area of land for an agricultural biogas plant is no more than 1 ha;
- a special procedure for the location of a biogas plant above 1 MW – a location resolution of the municipal council;
- exempting specific, safe types of biomasses from restrictive waste regulations;
- using the digestate as fertiliser.

In addition, financial support for agricultural biogas plants is provided under NFEP&WM programmes – the 'Agroenergy' Programme and the 'Energy for Rural Areas' Priority Programme (see Measures 18 and 22 in the energy sector).

Educational and promotional projects

- *A series of training courses on environmental considerations for the construction and operation of biomethane plants*

In September 2022, the National Support Centre for Agriculture organised a series of training courses on environmental considerations for the construction and operation of biomethane plants. The events, in the form of webinars, were carried out on behalf of National Support Centre for Agriculture by the Polish Biomethane Association. The recipients of the trainings were representatives of public administration, including primarily the General Directorate for Environmental Protection and Regional Directorates for Environmental Protection, who have an impact on the application of the provisions of the *Act on the provision of information on the environment and its protection, public participation in environmental protection and environmental impact assessments*, and play a key role in administrative proceedings aimed at issuing a decision on environmental conditions, and can also provide information for investors interested in obtaining the aforementioned decision regarding biomethane installations. The training courses addressed issues such as the principles of operation of biogas and biomethane installations, the production of biomethane in different forms of concentration, the environmental benefits of biogas and biomethane installations and legal regulations.

- *A series of training courses on the establishment and operation of energy cooperatives in rural and urban-rural municipalities*

In autumn 2022, the National Support Centre for Agriculture organised 16 free training courses on the establishment and operation of energy cooperatives in rural and urban-rural municipalities. The trainings were held in each voivodship and were intended to disseminate knowledge among local government representatives about the activities of energy cooperatives

as new entities on the Polish energy market and their impact on development opportunities for local governments, businesses, farmers and residents. During the trainings, issues related to e.g., technical aspects of the operation of energy cooperatives in the context of optimising self-consumption, legal regulations on the establishment and operation of energy cooperatives, potential sources of funding for RES installations in energy cooperatives, spatial planning and conditions for the implementation of investments in energy cooperatives were addressed.

Cooperation agreement for the development of the biogas and biomethane sector in Poland

On the initiative of the Ministry of Climate and Environment, the 'Cooperation agreement for the development of the biogas and biomethane sector in Poland' was signed in November 2021. The aim of the initiative is to support the development of the biogas and biomethane sector by developing solutions whose implementation would stimulate its growth. The initiative is intended to help increase the participation of Polish entrepreneurs and technologies in the supply chain for the construction and operation of domestic biogas and biomethane plants. The parties to the agreement are representatives of government administration and representatives of entities participating in the supply chain for the biogas and biomethane sector, organisations from the business environment, financial institutions and representatives of the academic world. The agreement sets out a framework for a partnership between the government and a wide range of stakeholders, for the common goal which is to realise the country's potential in creating a modern, innovative and low-carbon economy. In March 2022, the first meeting of the Coordination Council for the Development of the Biogas and Biomethane Sector took place. Within the agreement there are working groups dealing with a broad spectrum of issues related to the development of this area.

Methodology for estimating the reduction effect

The ex-post reduction effect of this measure has been estimated using historical data on electricity production in agricultural biogas plants from renewable raw materials available in the 'Register of agricultural biogas producers' kept by the National Support Centre for Agriculture and using the emission factor of electricity production in Poland in 2022. No data are available to estimate the ex-ante reduction effect.

4.2.6. LULUCF

Key strategic documents and regulations

The following tables summarise the key national policy documents and regulations for the LULUCF sector, affecting its operation and conditioning environmental and climate protection.

Table 39. Key strategic documents in the LULUCF sector

Document title	Document description
Strategic Plan for the Common Agricultural Policy for 2023-2027, approved by the European Commission on 31 August 2022	The Strategic Plan for the Common Agricultural Policy for 2023-2027 is directed to farmers. The new perspective supports investments to increase the forest ratio, improve the condition of Poland's forests and enhance their biodiversity.
The National Programme for the Augmentation of the Forest Cover adopted by the Council of Ministers in 1995 and updated in 2014	The programme sets out tasks aimed at increasing the country's forest ratio to 30% by 2020 and 33% by 2050. It defines the amount of agricultural land to be afforested and presents a comprehensive action plan to rationalise the structure of use of the country's natural space.
National Forest Policy (NFP) adopted by the Council of Ministers on 22 April 1997	The document defines lines of action in the Forestry area and indicates the linkage of forestry with cross-sectoral and international systems.

Source: study by KOBiZE, IEP-NRI

Table 40. Key regulations in the LULUCF sector

Document title	Document description
Act of 16 April 2004 on nature conservation (Journal of Laws of 2024, item 1478)	The Act sets out the scope of conservation (necessary for the effective protection of Natura 2000 sites) - the implementation of the obligation under Council Directive 92/43/EEC (Habitats Directive) and the Directive 2009/147/EC (Birds Directive) and fulfilment, to the appropriate extent, the objective of these Directives, namely, to maintain or restore the proper condition of protected objects in the Natura 2000 network.
Act of 3 February 1995 on the protection of agricultural and forest land (Journal of Laws of 2024, item 82)	The Act sets out the rules for the protection of agricultural and forest land, its rehabilitation and enhancement of its use value, as well as the possible conversion of agricultural and forest areas for other purposes.
Act of 28 September 1991 on forests (Journal of Laws of 2024, item 530)	The Act sets out the principles for the conservation, protection and enhancement of forest resources and the principles for forest management in relation to other elements of the environment and the national economy. The objective is to preserve forests and their beneficial effects on the climate, air, water, soil, living conditions and human health, as well as on the balance of nature.
Act of 7 June 2001 on forest reproductive material (Journal of Laws of 2001, item 761)	The Act regulates the registration of forest basic material, marketing of forest reproductive material, control of forest basic material and forest reproductive material marketed, seed regionalisation.
Regulation of the Minister of Climate and Environment of 27 March 2023 on the good practice requirements for forest management (Journal of Laws of 2023, item 672)	The regulation sets out how the forest owner should proceed when preparing and implementing forest management activities.
Regulation of the Minister of Agriculture and Rural Development of 26 March 2019 on the detailed conditions and procedure for granting financial aid under the sub-measure 'Support for afforestation and creation of afforested areas' covered by the Rural Development Programme 2014-2020 (Journal of Laws of 2022, item 1931, as amended)	The regulation sets out detailed conditions and procedures for the granting, payment and reimbursement of financial assistance under the sub-measure 'Support for afforestation and creation of afforested areas' of the Rural Development Programme 2014-2020.
Regulation of the Minister of the Environment of 22 March 2006 on detailed principles of forest fire protection (Journal of Laws of 2022, item 1065)	The regulation sets out detailed rules for forest fire protection.

Source: study by KOBiZE, IEP-NRI

Policies and measures

LULUCF measures are largely concerned with forestry, including the protection of agricultural and forest land, the adaptation of forest management activities and the improvement of the country's forest ratio.

Measure 62. Rational management of agricultural and forestry land – protection of agricultural and forestry land

Description

To protect agricultural and forest land, legal restrictions have been introduced on the possibility of its conversion. Above all, land designated as wasteland in the land register and, if there is no such land, other land with the lowest production suitability may be used for non-agricultural and non-forest purposes. In the construction of facilities related to industrial activities, as well as other construction facilities, such solutions should be used that limit the effects of negative impacts on the land. In

addition, the use of agricultural and forest land for non-agricultural and non-forest purposes, requires the approval of the relevant institutions.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

Measure 63. Development of forest areas and improvement of forest vitality

Description

Increasing the forest ratio is an important element of Poland's ecological, spatial and economic policy, including being one of the main objectives of the State Forest Policy. Methodological assumptions in this respect are set out in the National Programme for the Augmentation of the Forest Cover, adopted by the Council of Ministers in 1995 and updated periodically. Its aim is to provide the conditions for increasing the country's forest ratio (33% in 2050), as well as the optimal distribution of afforestation, setting environmental and economic priorities and implementation instruments. Measures implemented under the CAP (RDP 2014—2020, Strategic Plan for the CAP for 2023—2027) targeted at developing forest areas and improving forest vitality also contributed to the goal of improving forest ratio.

Afforestation and woodland creation

Afforestation is of great value for climate, soil and water conservation. Forested areas absorb CO₂, accumulate carbon and improve the water management of the land. Since 2004, afforestation has been supported by the RDP. By December 2020, afforestation of an area of 80,200 hectares was supported from this source and continues within the framework of the Strategic Plan for the CAP for 2023—2027. This programme supports measures that directly contribute to CO₂ sequestration and therefore reduction of CO₂ emissions while adapting to climate change. The aim of this measure is to increase forested areas through afforestation and the creation of wooded areas. Aid shall be granted to land listed in the land and building register as agricultural land, being arable land or orchards, intended for afforestation in the local spatial development plan or in the study of conditions and directions for spatial development. This measure is intended for afforestation of agricultural land characterised by low suitability for agriculture, representing a potential area for the establishment of forestry crops, as well as shaping the landscape structure of rural areas.

Support for investments that increase the resilience of forest ecosystems and their environmental value

The objective of this measure, implemented under the CAP 2014—2020 from 2019 and continued under the Strategic Plan for the CAP for 2023—2027, is to support investments that increase the resilience of forest ecosystems and their value for the environment. This measure covers investments contributing to the conversion of unfavourable stand structure to a near-natural or semi-natural stand. Thanks to this support, investments are implemented in the existing private forests aged 11—60 years, consisting in diversification of the species composition of tree stands, which significantly enriches biodiversity and has a positive impact on soil conditions by shielding the soil from harmful abiotic factors. In addition, the aim of this sub-measure is to increase the resistance of stands to harmful biotic factors through the establishment of forest stations – the introduction of specific species of tree and shrub plants (including e.g., shrubs and fruit trees) growing at a considerable density, increasing the ecological stability of the forest. By supporting silvicultural treatments (late cleaning), the natural resilience of the stand is increased, which is particularly important in view of the need to mitigate and adapt to climate change.

Forest and afforestation investments and bonuses

From 2023 onwards, the following forestry and afforestation interventions are implemented under the Strategic Plan for the CAP for 2023—2027:

- Afforestation of agricultural land – an intervention dedicated to agricultural land characterised by low suitability for agriculture, representing a potential area for the establishment of forestry crops, as well as shaping the landscape structure of rural areas.
- Creation of mid-field woodlots – an intervention leading to the diversification of the agricultural landscape, helping to maintain the ecological balance in rural areas, providing a habitat and food base for many organisms.
- Establishment of agroforestry systems – a new type of investment, not yet implemented in Poland, under the CAP. Agroforestry systems are a way of using agricultural land where trees or shrubs are integrated with agricultural cultivation on the same area. It is a multifunctional land use with environmental and climatic benefits.
- Enhancing the biodiversity of private forests – an intervention targeting private forests aged 11—60 years that require significant inputs to keep them in good condition. Support under this intervention is granted for investments to introduce reforestation in existing forests, taking into account the local habitat, environmental and climatic conditions of the area, to increase biodiversity as well as to increase carbon sequestration from the atmosphere. Support is also provided for carrying out maintenance cuts that contribute to increasing the resilience of stands to climate change.
- Bonuses for afforestation, tree planting and agroforestry systems.

Forest Carbon Farms (FCF)

The aim of this measure, which is implemented by the State Forests, is to demonstrate the role of forest areas in mitigating the negative effects of climate change and absorbing atmospheric CO₂. FCF activities are carried out in 23 forest districts and are expected to cover 12,000 ha of forest. It is assumed that they will continue for 30 years, and their effect will be monitored. Additional measures are being conducted in selected forest districts to expand the vertical structure of the forest by introducing new generation under the cover of old trees, using different methods of forest renewal and maintenance works that reduce carbon emissions from the soil, using species with higher natural carbon removal capacity. The work takes place on selected forest plots and aims to store additional carbon. The pilot part covers a period of 10 years (2017—2026) and the period for modelling the effects, as well as the sustainability of the effects, is expected to be 30 years. The project investigates and reports the amount of CO₂ sequestered by the forest ecosystem, mainly stand and soil, using the so-called Canadian CBM CFS3 model (Carbon Budget Model), which is parameterised to Polish natural and forest conditions.

Methodology for estimating the reduction effect

The ex-ante reduction effect of this measure has been estimated using the projected activity dynamics (land use area) in the sector LULUCF taking into account land conversion assuming an increase in the country's forest ratio to 33% by 2050. No data are available to estimate the ex-post reduction effect.

Measure 64. Prevention of forest fires***Description***

Protecting forests from fires is important for the preservation of their area and function. Measures carried out in the application of forest fire protection instructions, as well as the establishment of forest access bans, contribute to the prevention of forest fires.

Forest Fire Protection Manual

The document contains general and detailed principles of fire protection, guaranteeing a proper level of forest fire safety, including the principles of forecasting forest fire danger, the method of making fire protection strips next to railway lines, classification of fire causes, standardised methods of proceeding in case of a forest fire as well as guidelines on marking fire access and water drawing points. It also defines protective undertakings implemented by the organisational units of the State Forests depending on the degree of forest fire danger and an instruction on the use of aviation for detecting and extinguishing forest fires. The document establishes a classification of the threat of forest stands according to classes of flammability, supplementing the previously used classification of forest areas into categories of forest fire danger. This is a document being developed by the State Forests, the most recent being prepared in 2020.

Prohibitions on entering the forest

State forests are accessible to all – this is guaranteed by the Act of 28 September 1999 on forests. However, in special cases, the forest manager may impose a periodic ban on entering the forest in the area administered by the forest district. This is done to protect nature or to ensure the safety of people. Prohibitions on entering the forest are regulated by Article 26 of the Act on Forests. It stipulates e.g., that the forest inspector should impose a periodic prohibition of entry into a forest owned by the State Treasury when there is a high fire risk. Forests subject to a permanent or periodic entry ban shall be marked by signs with the inscription 'entry prohibited' and an indication of the reason and date of the ban. The obligation to erect and maintain the signs is incumbent on the forester for forests under the management of the State Forests and on the owners of other forests. This obligation is further specified in § 12 of the Regulation of the Minister of the Environment of 22 March 2006 on detailed principles of forest fire protection. According to this provision, the ban on entering the forest shall be introduced at the 3rd degree of fire danger, if for the next 5 days the litter moisture content measured at 9 a.m. is lower than 10%. The organisational units of the State Forests determine the degrees of forest fire danger on a daily basis for 60 forecast zones not including mountain areas. Failure to comply with the ban on entering the forest is punishable by a fine (PLN 500).

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

4.2.7. Waste management**Key strategic documents and regulations**

The following tables summarise the key national policy documents and regulations for the waste management sector, affecting its operation and conditioning environmental and climate protection.

Table 41. Key strategic documents in the waste management sector

Document title	Document description
National Waste Management Plan 2028 (NWMP 2028) adopted by the Council of Ministers on 12 June 2023	NWMP 2028 is an update of NWMP 2022 and contains an actualisation of waste management targets to be implemented in 2023—2028 in the context of the current state of waste management in Poland. The effects of implementing the NWMP 2028 will be a reduction in waste generation, an increase in the amount of waste sent for recycling, the elimination of improperly conducted waste management, an increase in the environmental awareness of the public in terms of waste prevention and proper waste handling.
National Programme for Municipal Wastewater Treatment, the latest sixth update adopted by the Council of Ministers on 5 May 2022	The National Programme for Municipal Wastewater Treatment identifies the wastewater management needs of agglomerations and defines an action plan for equipping them with collective sewerage systems and urban wastewater treatment plants (WWTP). The document includes information on investments planned for construction and modernisation of sewerage networks and activities related to the construction, extension and/or modernisation of urban WWTP. The programme is updated every four years. The latest update is the sixth in a row. The VI update of the National Programme for Municipal Wastewater Treatment estimates needs and identifies actions for further equipping agglomerations with sewerage systems and urban WWTP. The document includes 1,524 agglomerations with a population equivalent $\geq 2,000$ and a list of their planned investments that are expected to contribute to reducing discharges of inadequately treated wastewater and their adverse impact on the aquatic environment. The local government units that are part of the agglomeration shall implement these planned investments by the end of 2027.
Poland's Roadmap towards the Transition to the Circular Economy (CE) (CE Roadmap) adopted by the Council of Ministers on 10 September 2019	The idea of CE (Circular Economy) is reflected in the Roadmap towards the Transition to the CE, which is one of the strategic projects included in the Strategy for Responsible Development for the period up to 2020 (including the perspective up to 2030) (SOR2020). The document defines a set of tools, both legislative and non-legislative, and its aim is to create conditions for implementing a new CE economic model in Poland. The document includes measures within the competences of various ministries. The actions proposed in the CE Roadmap mainly concern analytical and conceptual work, information and promotion, and coordination in the areas it covers. Poland's priorities within CE include: • innovation, strengthening cooperation between industry and the scientific sector, resulting in the implementation of innovative solutions in the economy; • creating an European market for secondary raw materials, where their movement would be easier; • ensuring high quality secondary raw materials, resulting from sustainable production and consumption; • developing the service sector.

Source: study by KOBIZE, IEP-NRI

Table 42. Key regulations in the waste management sector

Document title	Document description
implemented	
Act of 19 July 2019 on food waste prevention (Journal of Laws of 2020, item 1645)	The Act sets out the principles of food handling and the responsibilities of food sellers and NGOs to prevent food waste, as well as the negative social, environmental and economic impacts of food waste.
Act of 20 July 2017 on Water law (Journal of Laws of 2021, item 2233, as amended)	The Act regulates the management of water in accordance with the principle of sustainable development, in particular the shaping and protection of water resources, the use of water, the management of water resources and wastewater management issues.
Act of 14 December 2012 on waste (Journal of Laws of 2023, item 1587, as amended)	The Act sets out rules for handling waste in a way that ensures the protection of human life and health and the protection of the environment in accordance with the principle of sustainable development. The Act establishes a hierarchy of ways of dealing with waste: 1) waste prevention; 2) preparing for reuse; 3) recycling; 4) other recovery (e.g., energy recovery); 5) disposal.
Act of 11 May 2001 on the obligations of entrepreneurs in the management of certain waste and of the product fee (Journal of Laws of 2024, item 433)	The Act regulates the obligations of entrepreneurs concerning the management of certain types of waste and introduces a product fee aimed at promoting activities that reduce the amount of waste produced at the manufacturing and consumption stage. Its main objectives are to reduce the amount of waste, improve waste management and reduce the negative impact on the environment.

Document title	Document description
Act of 13 September 1996 on the maintenance of cleanliness and order in municipalities (Journal of Laws of 2024, item 399)	The Act sets out the tasks of the municipality and the obligations of property owners concerning the maintenance of cleanliness and orderliness, the conditions for conducting the activity of collecting municipal waste from property owners and managing this waste, and the conditions for granting permits to entities providing services within the scope regulated by the Act.
planned	
Draft Act amending the Act on packaging and packaging waste management and certain other acts (Extended Producer Responsibility Act, ERPA)	The draft Act provides for the responsibility of producers to collect, process and recycle the packaging waste of their products. Work is underway, and the public consultation stage of the draft legislative process has been completed.
Draft Act amending the Act on food waste prevention	The draft Act provides for amending the definitions of food waste and food seller, amending the requirements for a seller to enter into a contract with an NGO, increasing the fee for wasted food, introducing a maximum deduction from the fee, introducing a penalty for failure to implement education and information campaigns and increasing the fine for failure to pay the fee. Work is in progress. Inter-ministerial agreements and public consultations are ongoing.

Source: study by KOBIZE, IEP-NRI

Policies and measures

Measure 65. Rational waste management

Description

Rational waste management encompasses measures aimed at the implementation of the objectives of the National Waste Management Plan - primarily concerning the implementation of the waste management principles, and in particular the hierarchy of ways of handling waste, through: prevention of waste generation, reduction of the amount of municipal waste subject to landfilling, establishment and maintenance of universal selective waste collection systems, maintenance of an integrated and sufficient network of waste management installations in the country, expansion or modernisation of existing installations.

As part of these activities, a *Database on products, packaging and waste management* has also been established. NFEP&WM programmes on waste management are also being implemented, which include measures covering selective collection and waste prevention, waste management installations, development of a circular economy and support for municipal waste management. The key NFEP&WM and OPI&E 2014–2020 programmes to support rational waste management are outlined below.

Table 43. Key programmes supporting rational waste management

Name of Programme	Description
Selective collection and waste prevention	Subsidising activities, influencing the implementation of the principles of waste management and, in particular, the waste hierarchy, by prevention of waste generation, establishment and maintenance of universal systems of selective waste collection. Activities include issues related to the prevention of waste generation, maintenance of universal systems of selective waste collection, which include: construction or modernisation of stationary points of selective collection of municipal waste, development of technical infrastructure of logistic processes related to the acquisition, storage and distribution of unsold or unused food, development of digitisation of waste management processes through the purchase of software and hardware to operate the selective collection system and carrying out dedicated staff IT training.
Waste management installations	Measure aimed at the establishment and maintenance of an integrated and sufficient network of waste management installations in the country, expansion or modernisation of existing

Name of Programme	Description
	installations: recovery, including recycling, of selectively collected municipal waste, including bio-waste, thermal processing of waste generated from municipal waste with generation of thermal energy, installations for the neutralisation of waste other than municipal waste by processes other than landfilling, aimed at reducing the amount of non-municipal waste generated. The adaptation of existing facilities for the mechanical-biological treatment of non-segregated (mixed) municipal waste to the processing of selectively collected waste.
Circular economy	Dissemination of experience with the implementation of the circular waste economy in selected municipalities through investments concerning e.g.: selective waste collection systems, waste recycling facilities, environmentally friendly transport with a focus on public collective transport, energy efficiency including heat or electricity, circular economy in the household, circular economy in agriculture or agricultural processing, water saving as a resource in the household, municipal economy and entrepreneurship.
Use of alternative fuels for energy purposes	Reducing the pressure of the economy on the environment and increasing climate neutrality by transforming the energy sector to reduce GHG emissions, improving energy efficiency by optimising heat and power management using alternative fuels instead of conventional fuels, thereby improving air quality and climate. Support will be given to projects involving the construction of new, expansion or modernisation of existing installations for the thermal conversion of waste produced from municipal waste with energy generation under conditions of high-efficiency cogeneration.
Development of cogeneration (CHP) based on municipal biogas	Promoting energy generation in high-efficiency cogeneration conditions using municipal biogas. Among other things, the programme will contribute to harnessing the energy potential of municipal bio-waste to generate electricity and heat; improving the efficiency of energy generation; optimising the waste management system by increasing the recycling rates of municipal waste produced; developing energy production from RES; and reducing GHG emissions into the atmosphere.

Source: study by KOBIZE, IEP-NRI, based on information from NFEP&WM

Methodology for estimating the reduction effect

The reduction effect (ex-ante) of this action was estimated assuming the achievement of the NWMP 2028 targets, based on the difference between projected emissions and baseline year emissions. The reduction effect (ex-post) was calculated based on the difference between the emissions in 2022 and the emissions in the reference year.

Measure 66. Support for the development of water and wastewater management

Description

Support for the development of water and wastewater management is a measure covering NFEP&WM programmes concerning water and wastewater management, which aim to reduce the volume of untreated wastewater and the size of the load of pollutants, especially biogenic pollutants discharged with treated wastewater into the natural environment. The implementation of the programmes, financed from national and EU funds, contributes to the fulfilment of the objectives of the National Programme for Municipal Wastewater Treatment and its updates, the Act on Water Law and also implements the EU Council Directive of 21 May 1991 concerning urban wastewater treatment. The latest (sixth) update of the National Programme for Municipal Wastewater Treatment is effective from 5 May 2022.

The measures include e.g., the implementation of investments necessary for agglomerations with a population equivalent of $\geq 2,000$ to comply with the conditions of Directive 91/271/EEC, the development of water and wastewater management in industrial plants and agglomerations, the co-financing of water resources protection projects and the minimisation of the phenomenon of drought in Poland, as well as increasing the number of people benefiting from an improved municipal wastewater treatment system ensuring increased nutrient removal. The key NFEP&WM and OPI&E

2014—2020 programmes for supporting the development of water and wastewater management are presented below.

Table 44. Key programmes to support the development of water and wastewater management

Name of Programme	Description
Wastewater management within the framework of the National Programme for Municipal Wastewater Treatment	The aim of the programme is to improve the condition of surface and groundwater by equipping agglomerations with combined sewerage systems and wastewater treatment plants as part of the implementation of activities related to the National Programme for Municipal Wastewater Treatment.
Co-financing of projects under the Operational Programme Infrastructure and Environment and the European Funds for Infrastructure, Climate, Environment 2021—2027 Programme	The aim of the programme is to subsidise projects aimed at increasing the number of people benefiting from an improved urban wastewater treatment system ensuring increased nutrient removal, expansion or modernisation of municipal infrastructure. These measures also contribute to reducing the energy intensity of the systems, limiting the consumption of natural resources.
Water and wastewater management in industrial plants	The aim of the programme is to reduce pressure on the environment by reducing water consumption and the load of pollutants entering the environment with the wastewater generated by the food industry.

Source: study by KOBiZE, IEP-NRI, based on information from NFEP&WM

Methodology for estimating the reduction effect

The reduction effect (ex-ante) of this measure was estimated assuming the achievement of the National Programme for Municipal Wastewater Treatment targets, based on the difference between projected emissions and baseline year emissions. The reduction effect (ex-post) was calculated based on the difference between the emissions in 2022 and the emissions in the reference year.

Measure 67. Reduction of food losses

Description

The measure covers the statutory obligations of food retailers to reduce food waste at retail, aiming to tackle food waste as well as the negative social, environmental and economic impacts of food waste. The food waste prevention programme is also part of the NWMP 2028.

Food waste is generated at various stages of the food supply chain. To accurately calculate the food waste generated and the potential for further management, a new record-keeping system has been introduced in 2022, requiring waste generators with waste records to provide information on the weight and types of food waste produced in their waste generation and waste management reports. The food waste prevention targets identified in the NWMP 2028 include:

- 1) reducing the mass of food waste generated at all different stages of the food supply chain;
- 2) reducing food waste in catering and restaurants by implementing rational ordering, portioning of meals;
- 3) raising public awareness of food waste prevention and food waste handling;
- 4) ensuring effective donation of food with an expiry date approaching for use by the needy;
- 5) supporting activities related to the optimisation of production processes to reduce food losses and food waste generation in the processing and manufacturing of food products.

Methodology for estimating the reduction effect

The reduction effect of this measure has not been estimated due to the lack of the necessary data.

4.3. Other information on policies and measures

4.3.1. Withdrawn policies and measures

The table below summarises the PaMs that were included in the eighth national communication (NC8) and were subsequently withdrawn, so are no longer reported in the BTR1.

Table 45. List of policies and measures relevant to GHG emission reductions between 2025 and 2030, withdrawn against the list of policies and measures in the NC8 report

PaM in NC8	Reason for PaM withdrawal
Measure 3. Our Climate Campaign	The education campaign was under implementation from 2022 to 2023.
Measure 18. Research projects on methane removal using the technology of underground directional boreholes (DD-MET Project)	The DD-MET project was under implementation between 2019 and 2023.

Source: study by KOBIZE, IEP-NRI

4.3.2. Policies and measures affecting GHG emissions from international transport

The table below summarises the PaMs relevant to reducing GHG emissions from international transport.

Table 46. List of policies and measures relevant to reducing GHG emissions from international transport

Measures affecting emissions from international transport
Measure 51. Measures for the environmentally friendly development of maritime shipping – environmental standards
Measure 51. Measures for the environmentally friendly development of maritime shipping – use of renewable and low-carbon fuels in maritime transport
Measure 53. Innovative measures for air transport – Carbon offsetting and Reduction Scheme for International Aviation (CORSIA)

Source: study by KOBIZE, IEP-NRI

4.3.3. Information on the impact of policies and measures on longer-term trends in GHG emissions and removals

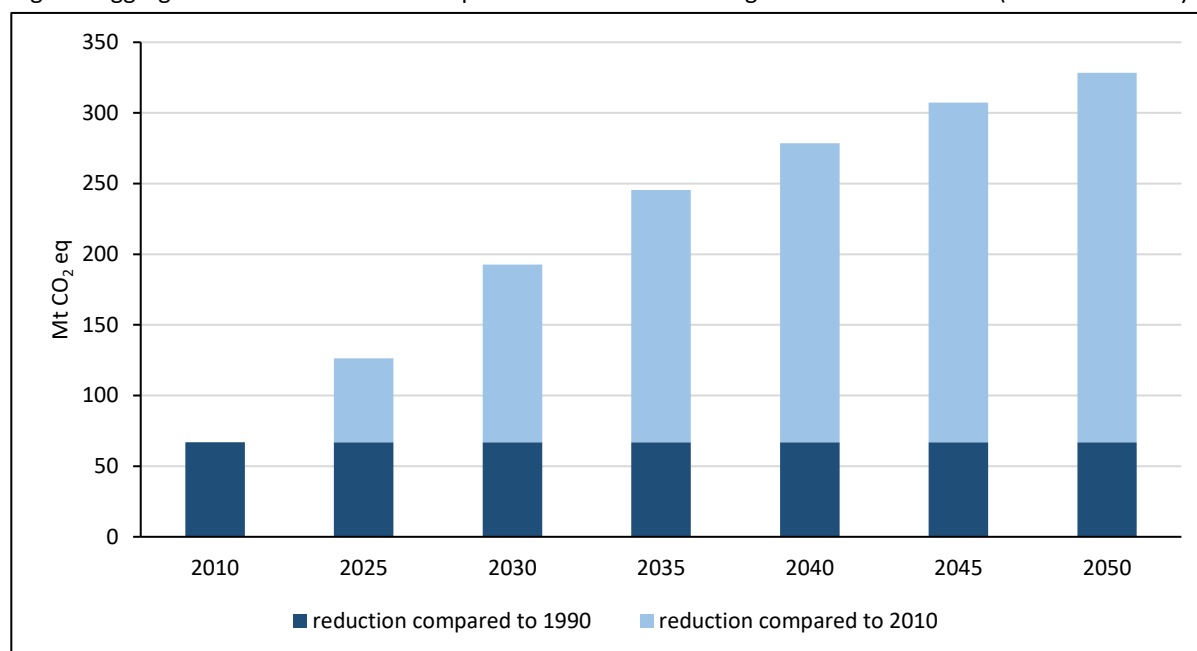
The impact of policies and measures on longer-term emission trends can be assessed by analysing estimates of the reduction effects of such policies and measures. Information on the effects of individual policies and measures is included in CTF Table 5.

Due to limited data availability, the data presented in CTF Table 5 do not include the effects on all currently implemented or planned PaMs. However, based on the information presented there on the reduction effects of PaMs, it can be concluded that the policies and measures indicated there, including those currently being implemented, will have an impact on reducing GHG emissions up to 2030 and also in the longer term. Based on the data currently available, it can be concluded that measures in the energy sector will have the greatest impact on reducing emissions. However, the three measures with the most significant reduction effect in the 2030 horizon are the white certificates system, the development of energy audits and management systems, and the auction-based RES support system.

In addition, available GHG emission projection data show that the aggregate effects of PaMs implemented today are increasing over the 2050 horizon. Compared to 2010, the reduction effects of

implemented policies and measures in 2030 were estimated at an additional approx. 125 Mt CO₂ eq and in 2050 at approx. 261 Mt CO₂ eq. The results of these analyses are presented in the chart below.

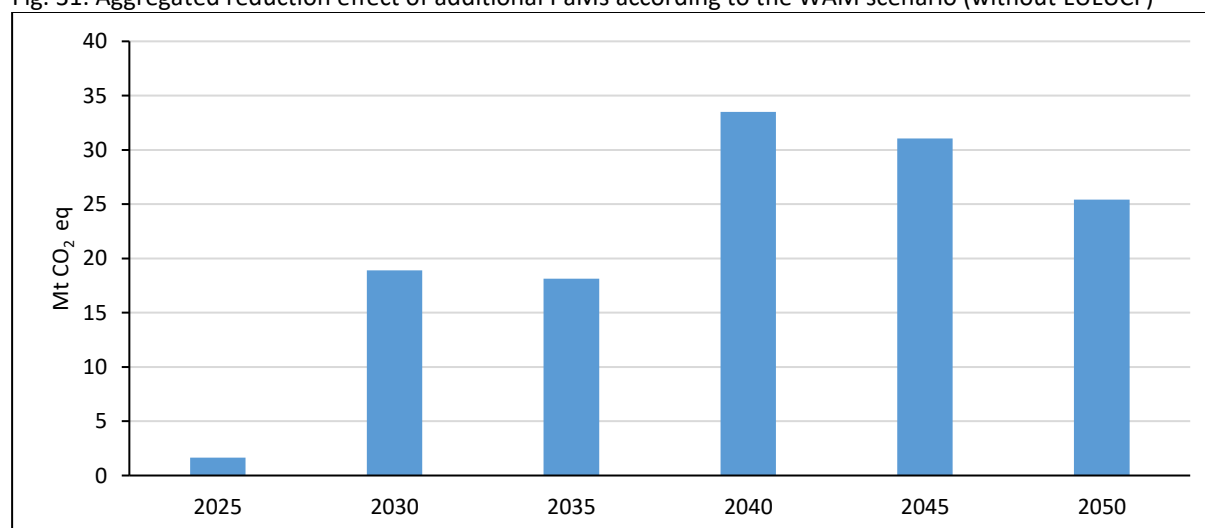
Fig. 30. Aggregated reduction effect of implemented PaMs according to the WEM scenario (without LULUCF)



Source: study by KOBIZE, IEP-NRI

The aggregated reduction effect of additional, planned PaMs can be estimated as the difference between the WEM and WAM scenarios' emissions. The levels of reductions calculated in this way are shown on the chart.

Fig. 31. Aggregated reduction effect of additional PaMs according to the WAM scenario (without LULUCF)



Source: study by KOBIZE, IEP-NRI

In summary, it can be concluded that, as can be seen from the data presented above, both the policies and measures already implemented and those currently in the planning stage will contribute to a significant reduction in GHG emissions in Poland, which in the 2050 horizon may reach approximately 121 Mt CO₂ eq, representing a reduction of approximately 74.5% compared to 1990 emission levels.

In addition, the removals by the LULUCF sector will not be negligible. According to the latest estimates, they could range from 24 Mt CO₂ in 2030 to 9 Mt CO₂ in 2050 (WEM scenario) and from about 42 Mt CO₂ in 2030 to about 19 Mt CO₂ in 2050 (WAM scenario).

4.3.4. Information on the assessment of the economic and social impacts of response measures

As Poland is a member of the EU, it should be noted that the national climate protection policy is closely linked to the climate policy of the entire Union. All major climate change policies, programmes, regulations and measures in the EU MS result directly or indirectly from the policies adopted at the EU level (in the form of documents and legal acts).

The European Union has established a process for assessing the consequences of its policies, including climate policy, to ensure that all relevant potential impacts are taken into account when working on a particular proposal. The potential impacts of designed solutions included in EC legislative proposals are thoroughly assessed through an impact assessment system that includes analyses of costs and benefits and all relevant economic, social and environmental impacts. This process is a key element in the development of new legislation in the EU and covers all draft legislation as well as drafts of other relevant documents. It ensures that the potential economic, social and environmental impacts of a regulation on the various stakeholders (inside and outside the EU) are identified and assessed during the legislative process. Each impact assessment follows the same procedure based on dedicated guidelines, also taking into account the opinion of the Impact Assessment Board. Accordingly, the EC, when preparing draft documents, develops extensive impact analyses of proposed solutions, covering the areas indicated above. This approach also applies to climate protection policies and measures, such as the 2020 energy and climate package, the 2030 energy and climate package or the 'Fit for 55' package. As part of these assessments, the EC takes into account third-party impact analyses with a view to minimising the negative impacts of planned policies. Based on these impact analyses, all EU MS decide whether to adopt (or not) the policy, programme or regulation in question. The EU decision-making process therefore enables all EU MS, including Poland, to assess potentially negative impacts on third parties already at the planning stage. The impact assessments and the opinions of the Impact Assessment Board are publicly available.

In addition to the impact analyses developed for each policy or regulation, the EU analyses and discusses the effects of its climate policy within the framework of its bilateral and regional cooperation, which is regulated by relevant agreements and cooperation agreements with e.g., Africa, Asia and Latin America or individual countries (e.g., Morocco, Tunisia, Georgia). Activities in this area are further outlined in the EU's BRT1.

In addition, in Poland, pursuant to the provisions of the *Act of 3 October 2008 on the provision of information on the environment and its protection, public participation in environmental protection and environmental impact assessments (EIA Act)*⁶⁶, implementing into the Polish legal order e.g., the Directive 2001/42/EC⁶⁷, certain types of documents developed or accepted by public administration institutions or other competent authorities are subject to strategic environmental impact assessment. The provisions of the above-mentioned Act, in Article 46(1)(2), regulate the principles of carrying out cross-border consultations with respect to policies, strategies, plans and programmes in the field of industry, energy, transport, telecommunications, water management, waste management, forestry, agriculture, fisheries, tourism and land use, developed or accepted by administrative authorities, setting the framework for the subsequent implementation of projects likely to have a significant

⁶⁶ Journal of Laws of 2023, item 1094, as amended.

⁶⁷ Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment (OJ L 197, 21.07.2001).

impact on the environment. Pursuant to the provisions of the aforementioned Act, if the possibility of a significant transboundary environmental impact is identified, a transboundary environmental impact procedure shall be conducted.

The strategic assessment process includes the preparation of an environmental impact forecast for a given policy or programme. The scope of the forecast is regulated in the EIA Act and must include e.g. information on possible transboundary environmental impacts. The preparation of an analysis of the international environmental effects of implemented policies results from the Espoo Convention under the auspices of the UNECE. The environmental impact assessment is made public and the countries concerned can express their opinion and possible concerns about the planned measures. When deciding on the implementation of a policy, the responsible authority must take into account the results of the consultations. During the implementation of the policy or programme, the responsible authority must monitor their environmental impact (including across national borders) and make the results of the monitoring public. These regulations ensure that potentially negative transboundary environmental and social impacts of the implementation of policies must be identified and taken into account already at the design stage.

5. Summary of GHG emissions and removals

This report presents the results of the national GHG emissions and removals inventory submitted to the UNFCCC in 2023. The new ETF Reporting Tool, responsible for preparing the Common Reporting Tables (CRT), enabled to finish the GHG Poland's Inventory Submission 2024 to the UNFCCC Secretariat on 27.11.2024 when the underlying report was completed. The report covers then the results for the period 1988-2021 and the following gases and GHG groups: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), HFC gas group (hydrofluorocarbons), PFC gas group (perfluorocarbons), sulphur hexafluoride (SF₆), nitrogen trifluoride (NF₃). Emissions are reported according to classification and in the format of the so-called Common Reporting Tables (CRT) in five main source categories: 1. Energy, 2. Industrial processes and product use, 3. Agriculture, 4. Land use, land use change and forestry (LULUCF) and 5. Waste.

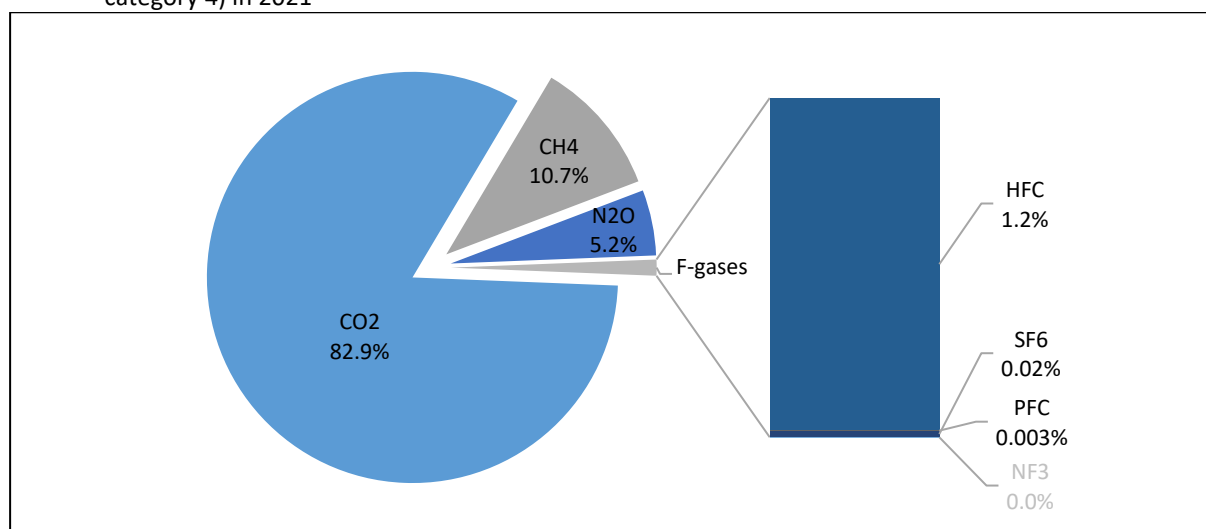
Global warming potentials (GWPs) from the IPCC's Fifth Assessment Report (AR5) were used when converting non-carbon dioxide emissions to CO₂ equivalents.

In accordance with the provisions of Article 4.6 of the UNFCCC Convention and Decision 9/CP.2, Poland uses 1988 as the base year for the implementation of commitments for the following GHGs: carbon dioxide, methane and nitrous oxide. For the following groups of gases: HFCs, PFCs and sulphur hexafluoride (SF₆) 1995 was adopted as the base year, while for nitrogen trifluoride (NF₃) the year 2000 was adopted.

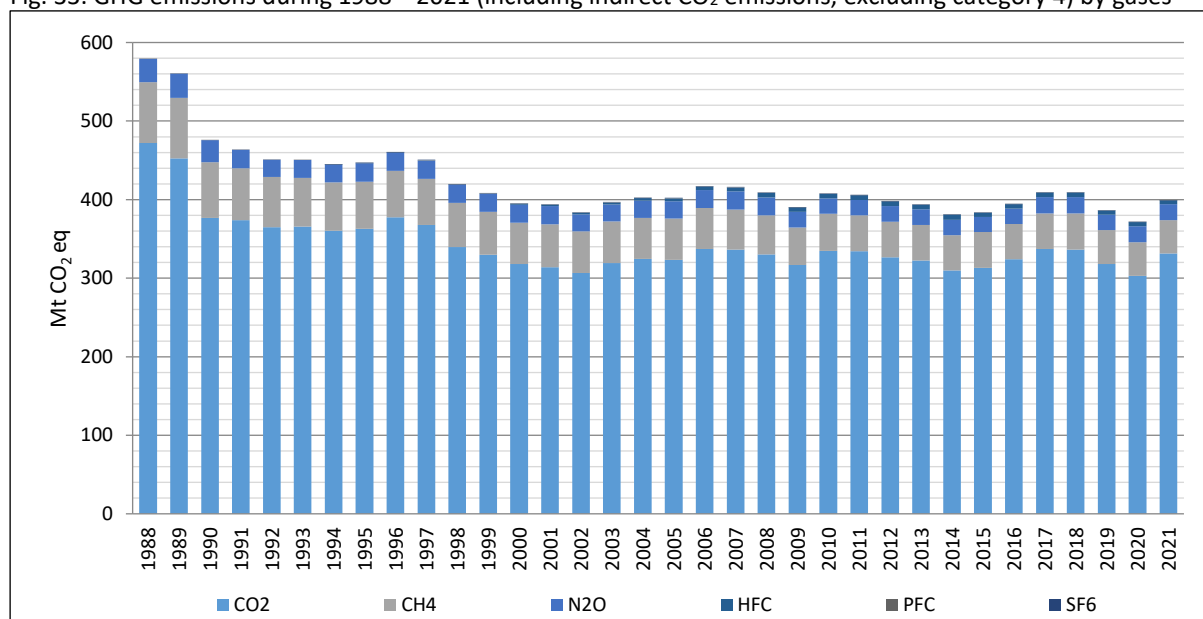
Total national GHG emissions in 2021 were 399.94 Mt CO₂ eq including indirect CO₂ emissions and excluding GHG emissions and removals from category 4. Land Use, Land Use Change and Forestry (LULUCF). Compared to 1988, emissions for 2021 decreased by 30.8%.

Carbon dioxide plays the dominant role in national emissions (82.9%). The share of methane and nitrous oxide is much smaller at: 10.7% and 5.2%. Fluorinated industrial gases (F-gases) account for a small share of national GHG emissions (ca. 1.3% in total), with no NF₃ emissions recorded in Poland. The shares of individual gases in 2021, excluding emissions and removals from category 4, are illustrated on Fig. 32, and the changes in emissions of individual gases since 1988 on Fig. 33.

Fig. 32. Shares of individual GHGs in total national emissions (including indirect CO₂ emissions, excluding category 4) in 2021



Source: KOBiZE, IEP-NRI

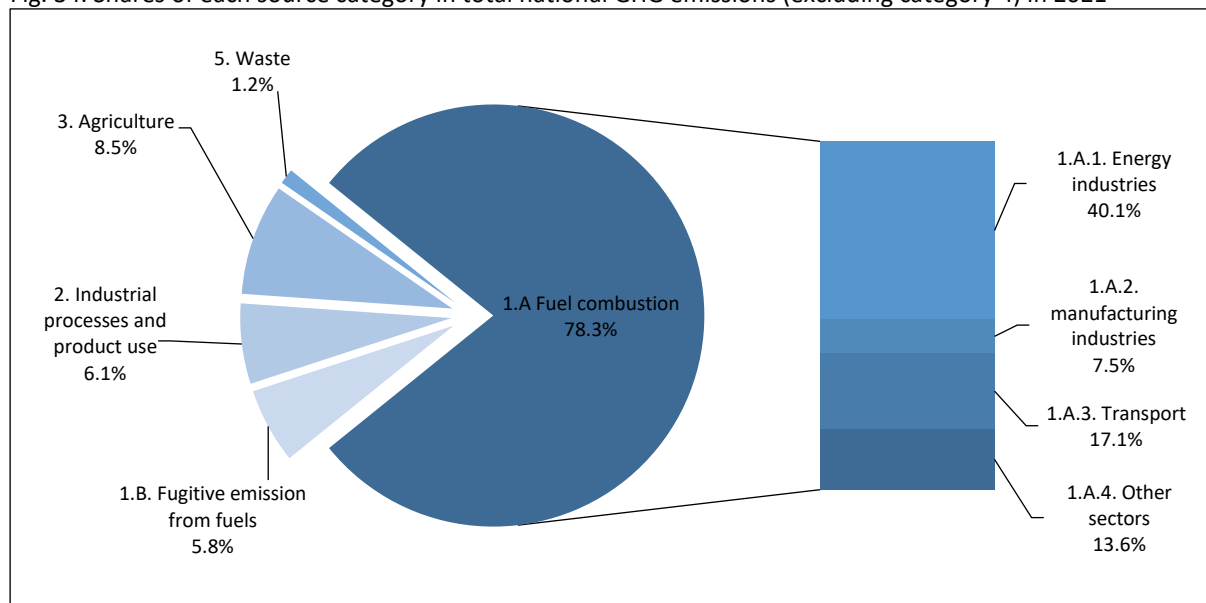
Fig. 33. GHG emissions during 1988–2021 (including indirect CO₂ emissions, excluding category 4) by gases

Source: KOBiZE, IEP-NRI

The course of changes in aggregate GHG emissions shows a significant decrease between 1988 and 1990 due to significant changes in the Polish economy, especially in heavy industry. This situation was a result of the political transformation initiated and the transition from a centrally controlled to a free market economy. A significant decrease in emissions lasted until 1992, after which, as a result of economic growth, emissions began to rise slightly, reaching a peak in 1996. The following years were characterised by a slow decrease in emissions until 2002, accompanied by programmes and measures for the efficient use of energy, followed by a slight increase in emissions, lasting until 2007, stimulated by the revived economic development. Between 2008 and 2011, GHG emissions fluctuated little, except in 2009, when there was a significant decline due to the global economic recession. After a decrease between 2012 and 2014, GHG emissions in Poland started to increase slightly as a result of the economic recovery (Fig. 33). The increase in GHG emissions between 2016 and 2018, in addition to economic prosperity, was significantly influenced by an increase in fuel consumption in the road transport sector, resulting e.g., from an effective fight against the grey market for liquid fuels initiated in 2016, as well as an increase in freight work related to dynamic economic development. After 2018, a decrease in national GHG emissions was recorded – by 6% in 2019 and by a further 4% in 2020 compared to the previous year. The main reason for the decrease in emissions in 2020, which was the first year of the COVID-19 pandemic, was lower consumption of fuels burned in stationary sources (hard coal by more than 6% and lignite by more than 8%) and in transport (petrol by nearly 7% and diesel by nearly 3%). In addition to the energy sector, emissions in the industrial processes sector also decreased. This is mainly the result of a decline in production of the steel industry (reduction of converter steel production by 20%, pig iron by more than 18% and sinter by about 24%). In 2021, national emissions increased again (by nearly 8%) compared to the previous year and approached 400 Mt CO₂ eq. The most significant increase in GHG emissions in 2021 was in fuel combustion sector – by 10%. This was driven by their higher consumption: hard coal by 10.6%, lignite by 19.0% and natural gas by 10.3% in stationary sources, and gasoline by 10.6%, diesel by 8.3% and CNG by 42.5% in transport.

The largest share of total GHG emissions (expressed in CO₂ equivalents) in Poland in 2021 (excluding the LULUCF sector) was in Sector 1. Energy (about 84.1%), and within this sector fuel combustion processes (78.3%). Agriculture was responsible for 8.5%, Industrial processes for 6.1% and Waste for 1.2% (Fig. 34).

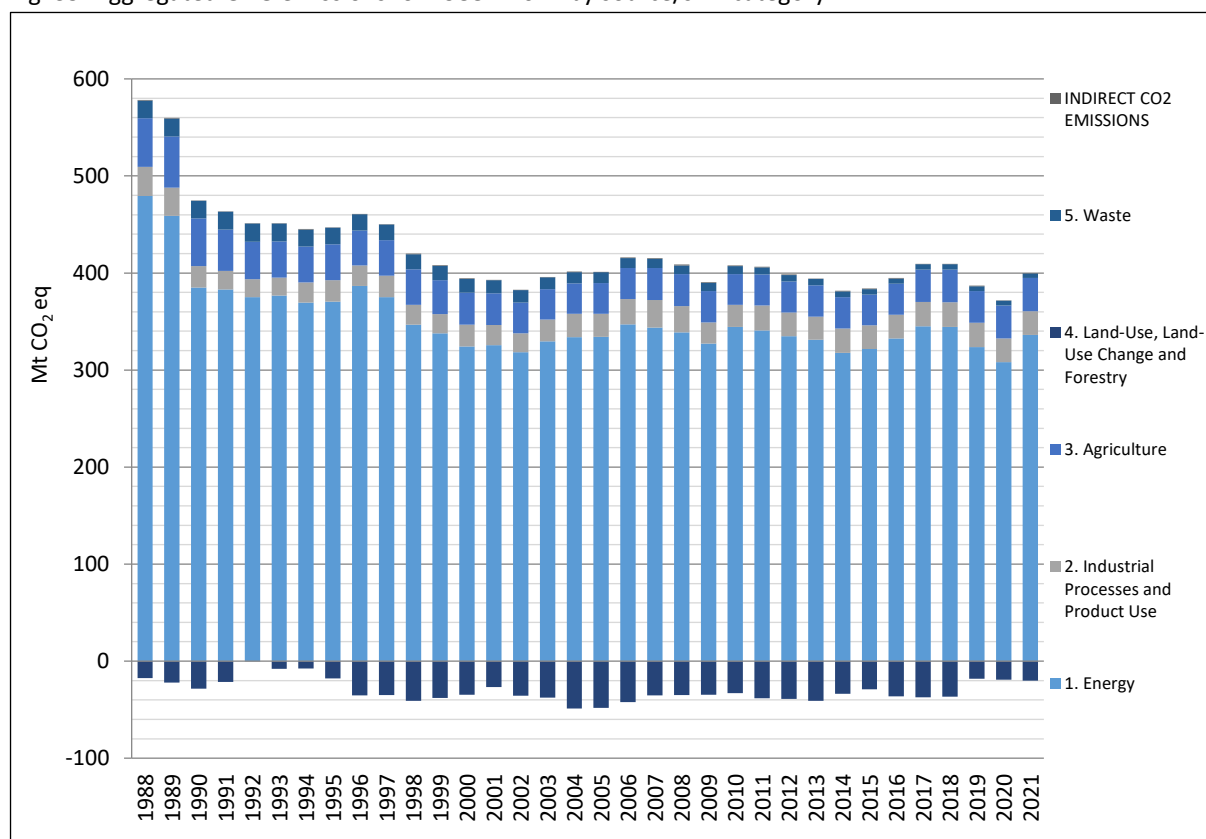
Fig. 34. Shares of each source category in total national GHG emissions (excluding category 4) in 2021



Source: KOBiZE, IEP-NRI

All source categories recorded a decrease in emissions compared to 1988. The largest decreases in GHG emissions were recorded in the categories: 5. Waste, 3. Agriculture and 1. Energy (by 74.4%, 32.0% and 29.9% respectively). In Sector 5, this was due to the development of waste disposal technology and legislation (which resulted in 58% of the waste mass being disposed of through landfill in 2021 compared to 1988), and the development of recycling and thermal waste disposal. In agriculture, such a significant decrease in emissions was due to structural and economic changes after 1989, including a decrease in livestock and crop production (e.g., there was a decrease in cattle numbers between 1988 and 2021 from over 10 million head to about 6 million head, sheep from over 4 million head to about 288,000 head). In contrast, the reduction of emissions in category 1. Energy was mainly related to the transformation in heavy industry and the decline in coal consumption and extraction, as well as measures to improve energy efficiency. For Sector 4, 2021 is the next consecutive year for which the level of carbon accumulation in Polish forests did not reach the level recorded over the years prior to the collapse of the trend of this accumulation in 2019. 2021 is the next consecutive year for which carbon accumulation (CO₂ removal) in Polish forests is assumed not to reach the level recorded over the historical years. The main reasons for the significant decrease in removals (in the form of a collapse in the dynamics of growth in the volume of wood resources) in forests from 2019 onwards include the long-term effects of natural disasters – drought occurring since 2014, hurricane winds (and associated windfalls) in 2017, which are the direct cause of changes in the estimated standing wood stock, the ageing of stands affecting the reported level of annual live increment and, importantly, significant changes in the dynamics of deadwood generation and the reported characteristics in this respect (Fig. 35).

Fig. 35. Aggregated GHG emissions for 1988–2021 by source/sink category

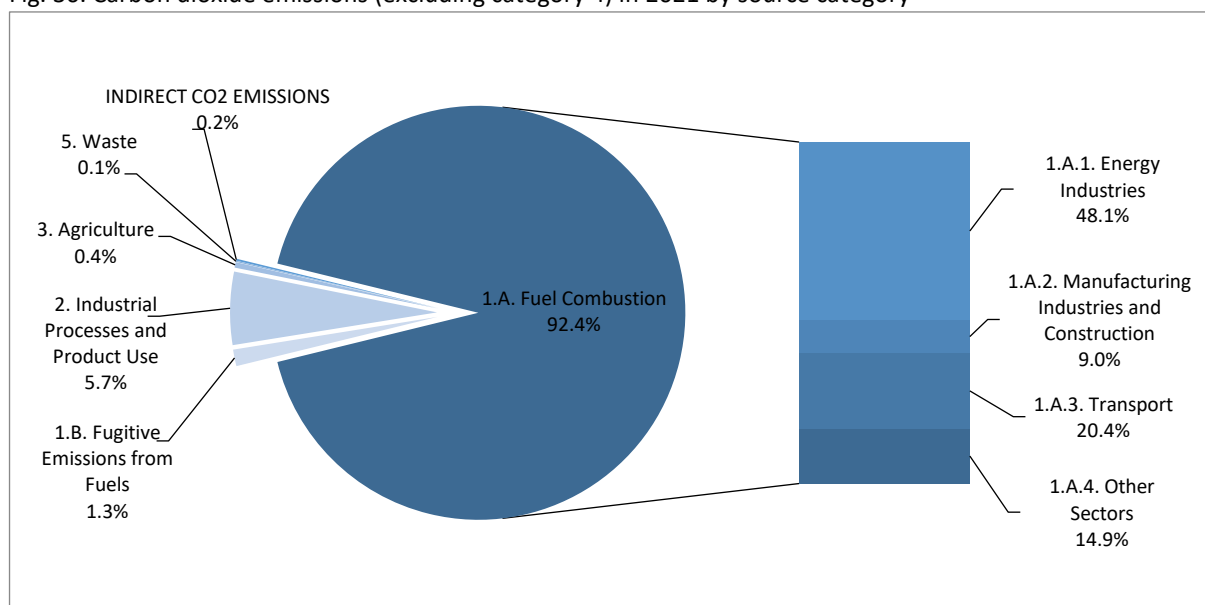


Source: KOBiZE, IEP-NRI

Carbon dioxide (CO₂) emissions

CO₂ emissions (excluding category 4) in 2021 was estimated at approx. 331.58 Mt. This is 29.8% less compared to 1988 emissions and 9.4% more compared to 2020. The main source of CO₂ emissions is the fuel combustion sub-category (1.A). This sub-category accounted for 92.4% of total CO₂ emissions in 2021. The shares in total CO₂ emissions of the main sub-categories included in category 1.A were as follows: Energy – 48.1%, Manufacturing and construction – 9.0%, Transport – 20.4% and Other sectors – 14.9%. For the Industrial processes and product use category, the share of total CO₂ emissions in 2021 was 5.7%. In this category, the main source of emissions is Mineral Products (especially Cement Production) (Fig. 36). The net balance of CO₂ emissions and removals in category 4 in 2021 was estimated at around -21.8 Mt, which means that CO₂ removals significantly outweigh emissions in this sector.

Fig. 36. Carbon dioxide emissions (excluding category 4) in 2021 by source category

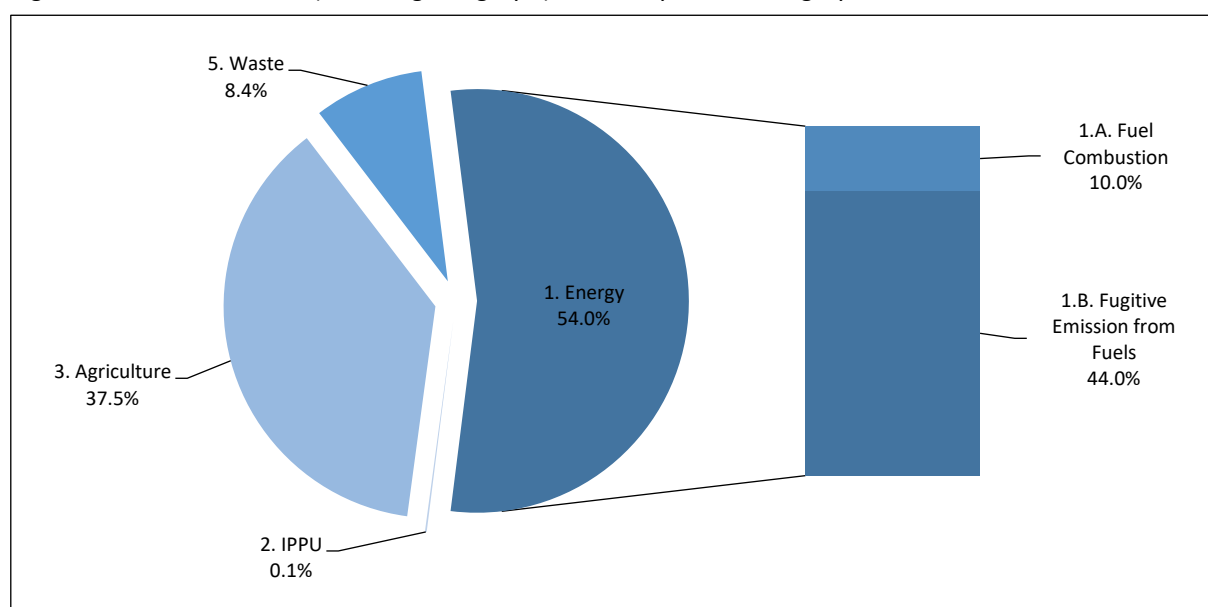


Source: KOBiZE, IEP-NRI

Methane emissions

Methane emissions (excluding category 4) in 2021 were 1 525.17 kt or 42.70 Mt CO₂ eq. Emissions in 2021 compared to 1988 were 44.0% lower and 1.1% lower than in 2020. Three of the major sources of methane emissions fall into the categories: Fugitive emissions from fuels, Agriculture and Combustion of fuels. Their shares in national methane emissions in 2021 are 44.0%, 37.5% and 10.0%, respectively. Emissions from the first category listed above consist of emissions from mines (37.1% of total CH₄ emissions) and emissions from oil and gas extraction, processing and distribution (6.9% of total methane emissions). Emissions from the sub-category Enteric fermentation (3.A) were the dominant source of emissions in the Agriculture category with a share of about 34.2% of methane emissions in 2021. Emissions from Landfills accounted for about 3.1% and from Wastewater Management for 4.8% of national methane emissions (Fig. 37).

Fig. 37. Methane emissions (excluding category 4) in 2021 by source category

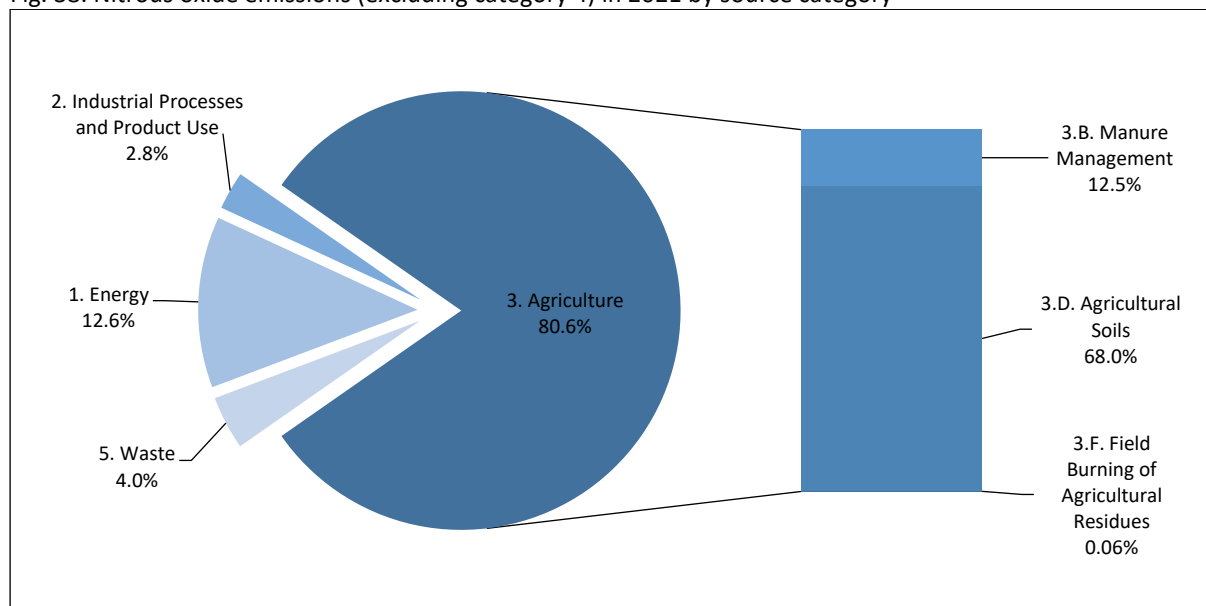


Source: KOBiZE, IEP-NRI

Nitrous oxide emissions

Nitrous oxide emissions (excluding category 4) in 2021 were 77.80 kt or 20.62 Mt CO₂ eq. N₂O emissions were 30.8% lower than in 1988 and 0.7% lower than in 2020. The main source of nitrous oxide emissions in Poland is Sector 3 Agriculture. The largest share in total N₂O emissions in 2021 from agriculture came from the subcategories: Agricultural soils – 68.0%, Animal excreta – 12.5%. Other significant sources of N₂O emissions included: Fuel combustion (in sector 1. Energy) with a share of 12.6%, Chemical industry (in sector 2. Industrial processes and product use) with a share of 2.2% of the total emissions of this gas, and Wastewater management (in sector 5. Waste) with a share of 3.3%. N₂O emissions by major categories are shown in Fig. 38.

Fig. 38. Nitrous oxide emissions (excluding category 4) in 2021 by source category



Source: KOBiZE, IEP-NRI

Fluorinated gases emissions

Emissions of fluorinated industrial gases (HFCs, PFCs and SF₆) in 2021 totalled to 5 039.94 kt CO₂ eq. Emissions of industrial gases were 3709.1% higher than in 1988. Such a significant increase in emissions in this group of gases is related to the increase in refrigeration and air-conditioning equipment in use. The shares of HFC, PFC and SF₆ emissions in total GHG emissions in 2021 are respectively: 1.23%, 0.003% and 0.02%. NF₃ emissions were not reported.

6. Projections of GHG emissions and removals

6.1. Introduction and the main socio-economic assumptions for the projections

This report presents national projections of GHG emissions and removals identical to those presented in the National Energy and Climate Plan (NECP 2024), which is currently under development. These projections have been prepared in two variants: according to the 'with existing measures' (WEM) scenario, which includes projected GHG emissions and removals taking into account adopted and already implemented policies and measures to reduce GHG emissions, and according to the 'with additional measures' (WAM) scenario, which includes additionally planned measures.

The projections in both scenarios include the following greenhouse gases: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), the HFC gas group (hydrofluorocarbons), the PFC gas group (perfluorocarbons) and sulphur hexafluoride – SF₆. So far, no NF₃ emissions have been recorded in Poland, so the projections assume that NF₃ emissions will also not occur in subsequent years. The following sectors according to the IPCC source classification were taken into account in the projections: Energy (including Transport), Industrial Processes and Product Use (IPPU), Agriculture, Land Use, Land Use Change and Forestry (LULUCF) and Waste.

In converting non-carbon dioxide emissions into CO₂ equivalents, global warming potentials (GWPs) from the IPCC Fifth Assessment Report (AR5) were used, as in the emissions inventory presented in Chapter 5.

The projections take into account the implementation of current policies and regulations in terms of improving energy efficiency, increasing security of fuel and energy supply, diversifying the fuel mix in the energy industry, developing the use of renewable energy sources, developing competitive fuel and energy markets and reducing the environmental impact of energy.

The projected development of the main external factors affecting energy system developments and GHG emissions under both scenarios is shown below.

Population

For the purposes of this report, the population projection for Poland based on EC guidelines has been used, adjusted slightly upwards to reflect immigration processes and extended to 2050 according to the trend line (Table 47).

Table 47. Population [million]

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Total	38.1	38.1	38.0	38.0	38.0	37.9	37.5	37.1	36.5	36.0
City	23.4	23.1	22.9	22.7	22.7	22.6	22.1	21.5	21.0	20.4
Village	14.7	14.9	15.1	15.3	15.3	15.3	15.4	15.5	15.5	15.5

Source: ARE S.A. based on EC guidelines and Statistics Poland projections

The demographic projection presented assumes a decrease in population in the considered time horizon from the current 38.0 to 36.0 million. It should be noted that the decline concerns the population in urban agglomerations, with a simultaneous, successive increase in the number of people living in rural areas. This is mainly due to the progressive movement of the population from cities to the countryside, most often to suburban municipalities clustered around large cities, since around

2000. The population projections adopted for the model calculations are higher than those presented by Statistics Poland, as the estimates of the Centre for Analysis and Research of the Union of Polish Metropolises⁶⁸ indicate higher values than those provided in official statistics.

GDP

The macroeconomic scenario, which served as the basis for the projection of energy demand in Poland in the 2040 perspective, was based on EC guidelines (assumptions for the PRIMES2020 Reference Scenario⁶⁹). The projection of GDP growth for Poland in absolute terms adopted for the model calculations is presented in Table 48, while the projections of average annual growth are presented in Table 49. The projections presented show an average annual GDP growth rate in Poland in the period under consideration of 1.8%.

Table 48. Gross Domestic Product [million EUR'2020]

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
GDP	286 657	361 804	419 955	475 755	561 399	632 335	689 801	738 296	777 582	810 026

Source: Eurostat, PRIMES2020 Reference Scenario

Table 49. GDP growth rate from 2021–2050 (annual average)

	2021–2025	2026–2030	2031–2035	2036–2040	2041–2045	2046–2050	2021–2050
GDP	103.6	102.4	101.7	101.4	101.0	100.8	101.8

Source: Eurostat, PRIMES2020 Reference Scenario

Sectoral gross value added

The structure of gross value added creation was determined using the macroeconomic assumption path adopted for the PRIMES2020 model (Reference Scenario). The values of this projection were slightly adjusted in the initial projection period to bring them in line with the 2020 statistics (Table 50). According to the assumed sectoral value added growth scenario, services will be the fastest growing sector of the economy, with value added in this sector almost doubling between 2020 and 2050. The second sector driving the economy, alongside services, is industry. The growth in value added in industry between 2020 and 2050 will be around 75%.

Table 50. Sectoral gross value added [million EUR'2020].

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Gross value added	253 404	318 290	369 495	417 356	492 952	555 333	605 838	648 466	683 019	711 608
Industry	52 112	74 580	90 851	103 547	123 007	139 249	152 877	163 909	172 833	180 900
Agriculture	9 312	9 284	8 624	8 958	9 447	9 961	10 213	10 342	10 418	10 407
Transport	16 527	16 831	21 386	20 554	27 768	32 094	35 449	38 515	41 018	43 061
Construction	20 772	27 023	32 431	36 001	43 006	47 285	49 998	52 238	54 105	55 776
Services	154 681	190 572	216 203	248 296	289 724	326 744	357 301	383 462	404 645	421 464

Source: Eurostat, PRIMES Ref2020, ARE S.A.

International fuel import prices

The fuel import price projections for the European Union, presented in Table 51, adopted for the model calculations have been based on EC guidelines. In the first years of the projections, values for hard coal and natural gas were adjusted to reflect the increase in the prices of these raw materials as a result of EU countries moving away from imports from the Russian Federation. The projections presented below, in turn, served as the basis for determining fuel prices on the domestic market.

⁶⁸ <https://metropolie.pl/artykul/34-million-ukrainians-in-poland-new-report-by-the-union-of-polish-metropolises>

⁶⁹ E3-Modelling: Prof. P. Capros, A. De Vita, A. Florou. Energy, transport and GHG emissions – Trends to 2050. PRIMES2020 Reference Scenario. Brussels/Athens, July 2021.

Table 51. EU import fuel prices [EUR'2020/GJ (NCV)].

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Natural gas	6.0	7.4	7.8	9.4	13.9	11.9	11.9	11.9	12.2	12.5
Hard coal	2.5	3.1	2.3	3.3	4.0	3.3	3.3	3.5	3.7	3.9

Source: ARE S.A. based on EC Guidelines to update the NECP

Prices for CO₂ emission allowances under the EU ETS

The projections for EU ETS CO₂ emission allowance prices adopted in the analysis are presented in Table 52. These prices were assumed using the document 'Summary of numerical assumptions for the NECP 2024 and EPP2040'⁷⁰ as to the development of the basic projection parameters. A linear increase in the cost of CO₂ allowances was assumed for the periods between the boundary years.

Table 52. EU ETS CO₂ emission allowance prices [EUR'2020/t CO₂].

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Price for 1 allowance	0	14	9	25	90	100	120	250	360	410

Source: EC Guidelines to the NECP

It was assumed that the price of CO₂ emission allowances in the EU ETS will gradually increase to a level of 410 EUR'2020/t CO₂ in 2050, which is in line with the European Commission's target to reduce GHG emissions by 90% compared to 1990 emission levels.⁷¹ This projection assumes that a significant increase in the price of CO₂ emission allowances will take place after 2035. One of the key mechanisms influencing the way CO₂ emission allowance prices will develop in the future will be the Market Stability Reserve (MSR). The biggest impact on the supply constraint and the increase in the price of allowances (EUAs) in the EU ETS in the 2030 horizon will be the increase in the linear reduction factor (LRF) introduced in the EU ETS Directive published in May 2023, from 2.2% to 4.3% in 2024–2027 and 4.4% in 2028-2030, together with a one-off rebasing of the allowance limit⁷². The extension of the 24% intake rate until 2030 will also have the effect of reducing the supply of allowances in the market significantly faster by increasing EUA transfers to the MSR. Combined with a strengthened LRF and rebasing in 2024, this will mean a strongly reduced supply already in 2025. After 2030, a further significant reduction in the supply of allowances in the system is expected, with a likely exhaustion of the pool of available allowances, roughly by the end of 2040.

Exchange rates

The EUR/PLN exchange rates were adopted according to the latest projections of the Ministry of Finance⁷³. They assume an exchange rate of 4.450 PLN/EUR. A USD/EUR exchange rate of 1.1 has been assumed for the calculations. Historical data for the years 2005-2020 is taken from the NBP archive data (Table 53).

Table 53. Exchange rates

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
USD/EUR	1.245	1.328	1.120	1.140	1.100	1.100	1.100	1.100	1.100	1.100
PLN/EUR	4.023	3.995	4.184	4.440	4.450	4.450	4.450	4.450	4.450	4.450

Source: National Bank of Poland (NBP), Ministry of Finance

⁷⁰ Summary of numerical assumptions for the NECP 2024 and EPP2040. Ministry of Climate and Environment, Warsaw 2022.

⁷¹ European Parliament resolution of 14 March 2019 on climate change – a European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy in accordance with the Paris Agreement.

⁷² Centre for Climate and Energy Analysis (CAKE). 'Completion of negotiations of key elements of the EU ETS under the 'Fit for 55' package'. Warsaw, January 2023.

⁷³ Ministry of Finance. Guidelines for the application of uniform macroeconomic indicators which are the basis for estimating the financial effects of proposed acts. Update, October 2023.

Number of heating and cooling 'day degrees'

Assumptions for the number of heating day degrees in the projection horizon were made using the EC recommendation for the preparation of the NECP⁷⁴. Historical data for the years 2005 -2020 comes from Eurostat databases. The assumed projections of the number of heating day degrees (HDD) and cooling day degrees (CDD) assume a gradual warming of the climate in the Polish climate zone (Table 54 and 55).

Table 54. Number of heating day degrees (HDD)

	2005	2010	2015	2020	2025	2030	2035	2040
HDD	3,547	3,881	3,113	3,442	3,430	3,418	3,408	3,399

Source: Eurostat, EC Guidelines for the NECP 2021—2030

Table 55. Number of cooling day degrees (CDD)

	2005	2010	2015	2020	2025	2030	2035	2040
CDD	216	197	220	223	226	229	231	233

Source: Eurostat, EC Guidelines for the NECP 2021—2030

6.2. Projections of GHG emissions and removals in the WEM scenario

6.2.1. Assumptions for the WEM scenario

Projections of GHG emissions to 2050 in the WEM scenario have been prepared using projections of activity change by sector, taking into account the IPCC source classifications, respectively, from the following data sources (Table 56).

Table 56. Data sources for activity change projections – WEM scenario

Sector	Main source of data	Additional sources of data/remarks
1. Energy	Projections of changes in activity in selected sectors, prepared by ARE SA for the preparation of the NECP 2024 report, included below.	Information obtained from industry organisations, industry studies and articles, etc. Statistics Poland projections
2. Industrial processes and product use		
3. Agriculture	Projections of activity changes for specific sectors of the economy, developed by the Institute of Environmental Protection – National Research Institute for the preparation of GHG and air pollutant emission projections, included in the report 'Projections of activity changes in selected sectors of the economy until 2040', December 2021.	Projection of agricultural sector activity in Poland until 2050 for the needs of the Institute of Environmental Protection – National Research Institute. Institute of Agriculture and Food Economics – National Research Institute. Edited by: PhD Konrad Prandecki.
4. Land Use, Land Use Change and Forestry (LULUCF)		Phase report of the project 'Importance of forests and land with forest vegetation in CO ₂ removal and storage in the framework of the new EU Forest Strategy for 2030 and the 'Fit for 55' package of acts.
5. Waste		National Waste Management Plan 2028 (NWMP 2028), Ministry of Climate and Environment 2023; Population forecast for 2023-2060, Statistics Poland 2023

Source: study by KOBIZE, IEP-NRI

Assumptions for the energy sector with the largest impact on national GHG emissions are described below. Table 57 presents the country's historical and projected primary and final energy consumption. The data presented shows a moderate decline in the country's primary energy demand between 2020 and 2030 from 103.3 Mtoe to 95.4 Mtoe and a subsequent acceleration of the rate of decline thereafter. Consequently, primary energy demand will fall to 90.0 Mtoe in 2040 and 83.4 Mtoe in 2050.

⁷⁴ Commission Notice on the Guidance to Member States for the update of the 2021-2030 national energy and climate plans 2022/C 495/02 (OJ C 495, 29.12.2022).

Final energy consumption over the period under consideration will fall from 77.1 Mtoe to 72.2 Mtoe in 2030 and then to 67.1 Mtoe in 2040 and 61.3 Mtoe in 2050.

Table 57. Total primary and final energy consumption (historical to 2020 and projected from 2025 onwards) – WEM scenario [ktce]

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Primary energy consumption*	92 905	101 819	96 061	103 280	101 355	92 215	88 561	90 029	89 586	83 366
Primary energy consumption	92 582	101 604	95 868	102 979	100 967	91 775	88 096	89 536	89 064	82 814
Final energy consumption*	61 700	70 380	65 169	77 134	75 642	72 234	69 573	67 104	64 157	61 330
Final energy consumption	57 473	65 250	60 863	70 257	70 171	66 845	64 269	61 936	59 247	56 840

*with non-energy consumption

Source: ARE S.A. own study (STEAM-PL, MESSAGE-PL), Eurostat

Final energy consumption (excluding non-energy consumption) by sector is presented in Table 58. It falls from 70.2 Mtoe to 66.8 Mtoe between 2020 and 2030. At the end of the projection, it reaches 56.8 Mtoe. Final consumption is assumed to decrease between 2020 and 2050 in all sectors of the national economy.

Table 58. Final energy consumption by sectors, excluding non-energy consumption (historical to 2020 and projected from 2025) – WEM scenario [ktce]

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Industry	14 616	13 498	14 097	15 921	16 002	15 391	14 870	14 405	13 970	13 660
Transport	12 223	17 187	16 561	21 779	23 494	21 831	20 346	18 900	17 390	15 937
of which: passenger	No data	No data	8 985	11 002	12 242	10 879	10 403	9 945	9 422	8 905
freight	No data	No data	7 496	10 695	11 168	10 865	9 857	8 869	7 881	6 944
special vehicles	No data	No data	79	82	84	86	87	87	87	87
Households	19 467	22 002	19 032	21 101	18 864	17 750	17 263	17 025	16 552	16 185
Services	6 730	8 833	7 842	7 565	8 170	8 401	8 485	8 473	8 387	8 277
Agriculture	4 438	3 730	3 330	3 869	3 640	3 473	3 305	3 133	2 949	2 781
TOTAL	57 473	65 250	60 863	70 235	70 171	66 845	64 269	61 936	59 247	56 840

Source: ARE S.A. own study (STEAM-PL), Eurostat

Table 59 shows final energy consumption by fuel. Gradual changes in the fuel structure are projected, with a significant decrease in coal consumption (its share will decrease from 14% in 2020 to 6% in 2030 and practically to zero in 2050), while the consumption of electricity and energy from renewable sources will gradually increase. Natural gas consumption will only increase until 2030, after which its share in final energy consumption will gradually decrease. Based on the assumptions made, a gradual, albeit slight, decrease in demand for district heating is also anticipated. This is the result of assumptions regarding large-scale thermo-modernisation measures and an increase in the use of heat pumps in individual heating systems. The decrease in hard coal consumption is mainly related to the slow but gradual process of modernisation of production facilities (in the industrial sector), partly due to the operation of the ETS, resulting in a switch to fuels and carriers such as RES or electricity. Subsequently, the process of replacing old, inefficient boilers in households, supported by subsidies (e.g., from the Clean Air Programme), will also influence the decrease in coal consumption. These processes are enforced e.g., through anti-smog resolutions introduced at the regional level, which prohibit the use of solid fuel boilers that do not meet certain environmental standards, and some introduce total bans on the use of solid fuels.

Table 59. Final energy consumption by fuel and carrier (historical to 2020 and projected from 2025) – WEM scenario [ktoe]

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Electricity	9 028	10 206	10 990	11 806	12 821	13 687	14 686	15 889	16 933	17 808
District heating	6 634	6 547	5 462	5 603	5 272	5 085	4 836	4 622	4 409	4 222
Coal	12 340	13 733	11 218	9 335	6 275	3 684	2 198	1 328	737	282
Petroleum products	17 563	20 213	18 647	24 384	24 653	21 743	19 508	17 163	14 818	12 629
Natural gas	7 917	8 884	8 490	9 236	10 373	10 679	10 376	9 296	8 033	6 942
Biogas	40	48	78	92	131	165	201	237	275	315
Solid biomass	3 755	4 306	4 639	7 447	6 786	6 422	6 110	5 734	5 258	4 822
Biofuels	47	867	653	1 040	1 498	1 733	1 754	1 776	1 776	1 776
Municipal and industrial waste	136	378	486	889	894	915	933	954	978	1 006
Solar collectors, heat pumps, geothermal	12	69	200	404	1 341	2 246	3 059	3 993	4 734	5 397
Hydrogen	0	0	0	0	6	49	164	464	815	1 159
Biomethane	0	0	0	0	121	438	444	480	479	481
TOTAL	57 473	65 250	60 863	70 235	70 171	66 845	64 269	61 936	59 247	56 840

Source: ARE S.A. own study (PL-PL), Eurostat

The gross domestic consumption of individual fuels and energy carriers is shown in Table 60.

Table 60. Gross domestic consumption of fuels and energy (historical to 2020 and projected from 2025 onwards) – WEM scenario [ktoe]

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Electricity	12 532	13 440	14 154	14 730	15 757	16 628	18 715	22 437	26 765	27 335
District heating	8 032	8 021	6 721	6 843	6 427	6 226	5 921	5 667	5 386	5 149
Hard coal	37 651	39 774	31 248	28,188	22 006	13 012	7 343	4 435	1 934	299
Coking coal	7 891	8 700	9 489	7 997	7 833	7 841	7 807	7 766	7 657	7 573
Coke	2 318	2 074	2 228	1 308	1 575	1 484	1 362	1 234	1 103	989
Lignite	12 726	11 579	12 299	8 850	8 598	4 002	997	45	3	1
Crude oil	18 459	23 184	26 506	25 992	24 686	23 128	21 831	20 371	18 611	16 761
Petroleum products	21 987	25 956	24 074	31 037	31 789	28 697	26 204	23 699	20 964	22 613
Natural gas	12 235	12 805	13 776	17 107	18 356	19 928	18 468	15 318	11 464	7 952
Coke oven gas	1 447	1 707	1 704	1 406	1 221	1 118	1 062	1 010	958	914
Blast furnace gas	560	526	632	464	551	458	319	200	111	31
Other gaseous fuels	161	149	163	84	83	81	71	70	66	67
Solid biomass	4 166	5 866	6 884	9 330	8 962	9 394	8 921	8 773	7,902	7,649
Biogas	54	115	229	322	535	755	962	1 088	1 301	1 411
Biofuels	54	868	782	1 042	1 498	1 733	1 765	1 787	1 788	1 789
Biomethane	0	0	0	0	120	438	455	491	490	492
Nuclear fuel	0	0	0	0	0	0	5 859	14 149	20 325	20 902
Hydrogen	0	0	0	0	6	51	555	1 209	2 918	4 354
Municipal and industrial waste	157	400	564	1 193	1 316	1 439	1 534	1 626	2 398	3 017

Source: ARE S.A. own study (STEAM-PL, MESSAGE-PL), Eurostat

The following conclusions can be drawn from the data presented in Table 60:

- the growth in domestic electricity consumption between 2020 and 2030 will be 13%, and between 2020–2050 – 86%. The average annual growth rate of this category is 1.7% throughout the forecast period under consideration. Electricity consumption will increase in all sectors, with the most significant increases in the transport, heating and industry sectors. In the transport sector,

electricity consumption in road transport (electromobility) is expected to increase primarily. The projection assumes that by 2030 there will be about 870,000 thousand and in 2050 about 5.8 million electrically powered vehicles on Polish roads, consuming respectively: 0.51 TWh and 12.2 TWh of electricity. The increase in industrial electricity consumption will be mainly associated with the modernisation and automation of production facilities. As a result of the energy transition process, solid fuels will gradually be replaced in the initial period partly by natural gas and then by technical solutions using electricity;

- a significant increase in electricity consumption in the transformed energy mix will relate to the use of heat pumps in heating. The development of individual heat pumps will affect the increase in electricity demand in households, while the use of centralised heat pumps in district heating plants will cause an increase in demand in the energy sector;
- a slight decrease in demand for district heating is projected (by 15% in 2020—2050), resulting from assumptions regarding the rate and scope of thermo-modernisation of buildings, the rate and scope of connection of new consumers and market conditions. The projection assumes that measures taken to combat so-called low emissions will become an incentive to invest in the development of district heating networks; at the same time, the assumed increase in CO₂ emission allowance prices will cause system heat, especially in the initial period of the projection, to gradually lose its competitiveness in comparison with individual heating technologies. However, this assumption is subject to the uncertainty of fuel prices and CO₂ emission allowances;
- a decrease in coal and lignite consumption resulting from energy transition processes is projected. The decline in coal consumption in the electricity and district heating sector will significantly accelerate already after 2028, when the capacity market for most coal-fired units will end. Coal consumption in buildings will drop to almost zero by 2040. In the above-mentioned sectors, there are essentially only trace amounts of coal consumption that will remain after this period;
- consumption of crude oil and petroleum products is expected to decrease over the analysed period. Improvements in energy efficiency, including a gradual reduction in the unit fuel consumption rates of new vehicles, as envisaged by EU legislation, also play an important role here;
- analysis results indicate an increase in national demand for natural gas in the 2030 perspective, followed by a gradual decline to 9.2 Mtoe in 2050. Natural gas in Poland will play the role of a transition fuel during the energy transition, but only in the initial 10—15 year period. Thereafter, it will be gradually replaced by zero-emission fuels and technologies;
- a further gradual increase in demand for renewable energy carriers such as biomass, biogas or biofuels is expected.

Table 61 presents data on gross electricity and district heat production in Poland.

Table 61. Gross electricity and district heat production (historical to 2020 and projected from 2025) – WEM scenario

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Electricity [GWh]	157 295	158 186	165 128	158 247	184 829	198 004	222 044	268 059	318 204	325 630
District heating [TJ]	336 292	335 831	274 357	285 870	268 062	259 586	246 296	235 252	223 427	213 384

Source: ARE S.A. own study (STEAM-PL, MESSAGE-PL), Eurostat

Electricity production by fuel is shown in Table 62.

Table 62. Gross electricity production [TWh] (historical to 2020 and projected from 2025) – WEM scenario

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Lignite	54.8	48.7	52.8	38.1	38.1	17.8	4.5	0.1	0.0	0.0
Hard coal*	88.5	89.3	79.4	70.7	67.3	40.9	21.1	14.4	6.1	0.3
Gaseous fuels**	5.2	5.1	6.4	17.4	21.8	31.9	27.9	17.3	6.6	0.0
Fuel oil	2.7	2.6	2.1	1.7	1.9	1.7	1.3	1.0	0.5	0.3
Nuclear energy	0.0	0.0	0.0	0.0	0.0	0.0	26.4	62.8	90.8	93.7
Biomass	1.4	5.9	9.0	6.9	6.8	8.7	7.5	8.1	6.2	6.6
Biogas	0.1	0.4	0.9	1.2	1.9	2.8	3.6	3.9	4.7	5.0
Hydro power	2.2	2.9	1.8	2.1	2.6	2.9	3.0	3.0	3.1	3.2
From pumped water	1.6	0.6	0.6	0.8	1.1	3.3	3.3	5.6	5.6	6.3
Onshore wind energy	0.1	1.7	10.9	15.8	25.6	38.1	47.1	49.3	59.8	61.3
Offshore wind energy	0.0	0.0	0.0	0.0	0.0	21.7	34.0	44.5	57.5	62.4
Solar energy	0.0	0.0	0.1	2.0	15.5	24.8	34.5	44.4	53.3	54.4
Geothermal energy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5
Hydrogen	0.0	0.0	0.0	0.0	0.0	0.0	2.5	4.8	13.0	19.8
Other***	0.7	1.1	1.0	1.5	2.2	2.4	2.4	2.6	2.6	2.7
Energy storage (batteries)	0.0	0.0	0.0	0.0	0.0	1.2	3.2	6.2	8.2	9.3
Total	157.3	158.2	165.1	158.2	184.8	198.0	222.0	268.1	318.2	325.6

* Including coke oven gas and blast furnace gas

** High-methane and nitrogen-rich natural gas, gas from mine de-methanation, associated petroleum gas

*** Inorganic industrial and municipal waste

Source: ARE S.A. own study (MESSAGE-PL), Eurostat

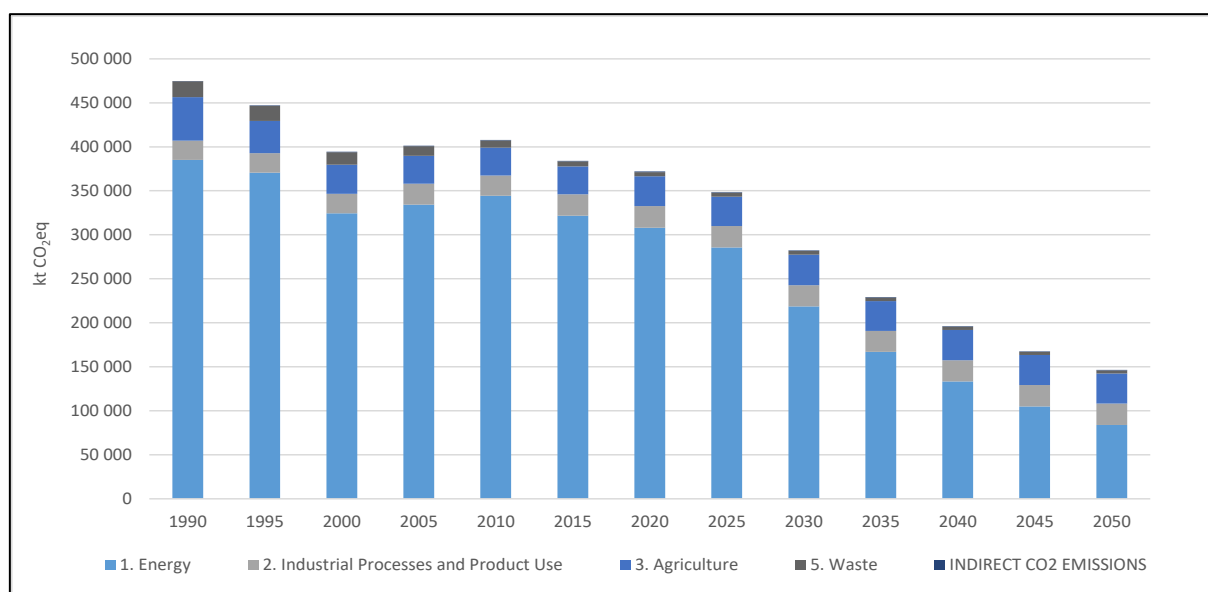
6.2.2. Projection results in the WEM scenario

Below are presented the aggregated results of the projected 2025-2050 GHG emissions and removals in Poland, compared with historical emissions in 2005-2020, by IPCC sector (Table 63, Fig. 39) and by gas (Table 64).

Table 63. Historical emissions (up to 2020) and projected GHG emissions (from 2025 onwards) by sector – WEM scenario

Sector	GHG emissions [kt CO ₂ eq]									
	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
1. Energy	334 317.08	344 423.02	321 729.78	307 991.99	285 675.98	218 770.25	166 885.60	133 290.94	105 030.45	83 831.83
2. Industrial processes and product use	23 732.01	22 878.65	24 351.84	24 516.29	24 223.83	24 038.87	24 001.47	24 177.30	24 211.94	24 248.02
3. Agriculture	31 659.42	31 659.66	31 705.48	34 051.67	33 334.78	34 650.27	33 810.60	34 519.85	34 285.23	34 379.71
4. Land Use, Land Use Change and Forestry (LULUCF)	-48 018.52	-32 962.30	-29 143.46	-18 957.85	-32 282.75	-24 550.49	-21 107.75	-14 266.51	-14 988.30	-9 651.75
5. Waste	11 000.17	8 275.63	5 608.23	4 752.48	4 652.44	4 268.70	4 041.42	3 786.22	3 568.86	3 372.02
Indirect CO ₂ emissions	564.93	567.87	546.19	582.52	545.78	539.97	531.84	523.60	520.79	518.42
Total (incl. LULUCF)	353 255.10	374 842.53	354 798.06	352 937.10	316 150.06	257 717.57	208 163.19	182 031.40	152 628.97	136 698.24
Total (excl. LULUCF)	401 273.62	407 804.83	383 941.52	371 894.95	348 432.82	282 268.06	229 270.93	196 297.90	167 617.27	146 349.99
CO ₂ emissions from biomass	19 802.69	30 378.55	34 917.41	48 969.63	48 439.50	51 811.61	50 249.71	50 018.17	46 467.08	45 582.00

Source: study by KOBIZE, IEP-NRI

Fig. 39. Historical emissions (1990–2020) and GHG emission projections (including indirect CO₂ emissions and excluding emissions and removals from LULUCF) by sector – WEM scenario

Source: study by KOBIZE, IEP-NRI

Table 64. Historical emissions (up to 2020) and projected GHG emissions (from 2025 onwards) by gas – WEM scenario

Gas	GHG emissions [kt CO ₂ eq]									
	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
CO ₂	323 329.98	334 792.45	313 261.61	303 019.61	285 675.29	223 131.34	175 151.54	143 847.68	117 303.56	97 295.97
CH ₄	51 776.88	47 759.43	45 941.23	43 188.11	39 194.79	36 132.37	31 793.73	30 202.95	28 045.62	26 636.63
N ₂ O	22 206.21	19 600.62	19 062.05	20 469.86	20 208.21	20 037.25	19 542.31	19 424.94	19 445.76	19 595.05
HFCs	3 761.45	5 598.16	5 583.52	5 114.48	3 217.85	2 804.91	2 596.83	2 613.01	2 613.01	2 613.01
PFCs	171.47	17.72	13.71	10.61	8.21	6.35	4.92	3.80	3.80	3.80
SF ₆	27.62	36.45	79.39	92.29	128.46	155.84	181.61	205.52	205.52	205.52
NF ₃	-	-	-	-	-	-	-	-	-	-
Total (excl. LULUCF)	401 273.62	407 804.83	383 941.52	371 894.95	348 432.82	282 268.06	229 270.93	196 297.90	167 617.27	146 349.99

Source: study by KOBIZE, IEP-NRI

It is projected that national GHG emissions (excluding LULUCF) will be 282.3 Mt CO₂ eq in 2030 and 146.3 Mt CO₂ eq in 2050, decreasing by almost 41% in 2030 and by more than 69% in 2050 compared to 1990. In the energy sector, emission reductions will be 43% in 2030 and 78% in 2050. The main factor reducing GHG emissions in the energy sector is the decrease in fuel consumption in both stationary and mobile sources. A significant reduction in GHG emissions is also observed in the waste sector (by 76% in 2030 and by 81% in 2050). In the agriculture sector, the decrease in GHG emissions will be 30% between 1990 and 2030 and will remain at a similar level until 2050, due to the projected volume of livestock and crop production. For the industrial processes and product use sector, emissions are projected to increase slightly by 9-10% between 2030 and 2050 compared to 1990.

A very large reduction in GHG emissions from fuel combustion is predicted over the projection years, amounting to more than 29% in the period 2020–2030 and more than 74% by 2050. The largest impact on this reduction is the reduction in GHG emissions in category 1A1a Electricity and heat production. The projected decrease in this category is around 42% by 2030 and almost 98% by 2050, compared to 2020. This is due to the reduction in fossil fuel use in this sector – by 2030, coal is expected to be reduced by almost 50%, lignite by over 54%, and by 2050, the assumed reduction in the use of



the aforementioned fuels in commercial electricity and heat production will be over 99%. This means an almost complete phase-out of the use of these fuels. A significant decrease in GHG emissions is also projected in category 1A4b Households, by almost 43% between 2020 and 2030 and by about 77% by 2050. For this sector, such a significant reduction is also linked to a decrease in fuel consumption (mainly coal) of 63% by 2030 and complete replacement of this fuel by other energy carriers by 2050.

Although the LULUCF sector systematically recorded carbon accumulation (CO₂ removal), a significant break in the trend of this ecosystem trait was observed in 2019-2021. Nevertheless, this appears to have been short-term in nature and reflected the effect of historical natural disturbances that have affected Polish forests in recent years. Current simulations carried out for forest land (the main sink in the sector) assume that a significant increase in carbon accumulation can be expected between 2022 and 2023, to approximately 32 Mt CO₂ eq in 2022 and 35 Mt CO₂ eq in 2023 (which is also the peak of the projected trend). In the longer term, however, carbon accumulation is expected to decline steadily to 24.5 Mt CO₂ eq in 2030 and 9.6 Mt CO₂ eq in 2050. The decline in these dynamics should be linked to two factors influencing the level of annual increment on an aggregate scale, namely the ageing of stands and a significant increase in the release of deadwood. Importantly, deadwood in forests will increase both as a result of a number of local and global environmental policies and also due to climate change increasing tree mortality.

The following tables (Tables 65, 66 and 67) present the results of the projected GHG emissions for 2025–2050 in Poland by sector and subsector, compared with emissions in 2005–2020, by gas.

Table 65. Historical emissions (to 2020) and CO₂ emission projections – WEM scenario

Sector	CO ₂ emissions [kt]									
	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
A. Fuel combustion	305 292.48	316 852.23	293 495.67	281 978.11	263 321.33	200 576.18	152 479.37	121 067.21	94 489.80	74 461.79
1. Energy industries	301 905.38	313 363.43	288 748.81	277 753.06	258 937.54	196 094.32	147 976.36	116 570.16	90 033.99	70 039.21
2. Manufacturing industries and construction	177 651.35	172 795.91	162 990.16	138 993.06	127 700.48	83 448.00	49 273.84	31 320.10	17 292.37	8 266.51
3. Transport	33 669.65	29 402.61	27 703.78	28 596.72	27 429.02	23 773.35	20 547.03	17 381.02	14 811.50	12 962.00
4. Other sectors	35 631.64	48 767.04	47 449.35	62 374.76	65 348.17	57 702.68	51 805.44	45 494.96	39 076.01	33 022.97
B. Fugitive emissions from fuels	54 952.74	62 397.88	50 605.53	47 788.52	38 459.87	31 170.28	26 350.05	22 374.08	18 854.11	15 787.72
1. Solid fuels	3 387.10	3 488.80	4 746.86	4 225.05	4 383.80	4 481.87	4 503.01	4 497.06	4 455.80	4 422.57
2. Crude oil and natural gas	2 225.64	2 424.68	2 712.17	2 340.89	2 192.35	2 203.28	2 202.24	2 199.09	2 175.61	2 158.58
2. Industrial processes and product use	1 161.46	1 064.11	2 034.69	1 884.16	2 191.45	2 278.59	2 300.77	2 297.97	2 280.20	2 264.00
A. Mineral industry	15 665.47	16 056.87	17 907.27	18 746.13	20 212.64	20 409.87	20 551.51	20 683.46	20 716.94	20 751.74
B. Chemical industry	8 355.79	9 849.54	10 088.59	11 738.98	12 675.14	12 882.64	13 074.52	13 261.82	13 380.56	13 492.25
C. Metal industry	4 886.78	4 335.42	5 141.13	4 866.96	5 030.36	5 081.79	5 128.55	5 176.50	5 198.51	5 220.29
D. Non-energy products from fuels and solvent use	2 236.00	1 639.16	2 419.96	1 824.37	2 172.04	2 118.33	2 030.39	1 934.56	1 836.18	1 745.71
3. Agriculture	186.90	232.76	257.59	315.82	335.10	327.12	318.05	310.59	301.70	293.48
G. Liming	1 591.35	1 121.19	1 108.98	1 458.75	1 320.98	1 330.75	1 314.26	1 298.85	1 301.48	1 289.48
H. Urea application	944.90	391.55	373.84	836.30	628.37	675.15	689.15	702.90	712.10	721.42
I. Other C containing fertilisers	394.18	467.17	471.24	431.33	473.00	426.14	400.71	376.39	372.24	353.12
4. Land Use, Land Use Change and Forestry (LULUCF)	252.27	262.46	263.89	191.13	219.61	229.46	224.40	219.56	217.14	214.94

Sector	CO ₂ emissions [kt]									
	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
5. Waste	-48 987.35	-33 870.34	-30 886.90	-20 783.76	-34 007.90	-26 193.09	-22 635.50	-14 985.63	-15 702.09	-10 365.17
C. Incineration and open burning of waste	215.76	194.29	203.50	254.10	274.56	274.56	274.56	274.56	274.56	274.56
A. Fuel combustion	215.76	194.29	203.50	254.10	274.56	274.56	274.56	274.56	274.56	274.56
Indirect CO ₂ emission	564.93	567.87	546.19	582.52	545.78	539.97	531.84	523.60	520.79	518.42
Total (incl. LULUCF)	274 342.63	300 922.11	282 374.71	282 235.85	251 667.39	196 938.25	152 516.04	128 862.05	101 601.47	86 930.80
Total (excl. LULUCF)	323 329.98	334 792.45	313 261.61	303 019.61	285 675.29	223 131.34	175 151.54	143 847.68	117 303.56	97 295.97
CO ₂ emissions from biomass	19 802.69	30 378.55	34 917.41	48 969.63	48 439.50	51 811.61	50 249.71	50 018.17	46 467.08	45 582.00

Source: study by KOBIZE, IEP-NRI

CO₂ will remain the main greenhouse gas emitted in Poland. Its share in national emissions will be 79% in 2030 and 66% in 2050. CO₂ emissions are projected to decrease significantly from nearly 377 Mt CO₂ eq in 1990 to 223 Mt CO₂ eq in 2030 (a decrease of 41%) and to 97 Mt CO₂ eq in 2050 (a decrease of 74%). The most significant decrease in emissions was in the Energy sector, due to a significant decrease in fuel consumption in stationary and mobile sources.

Table 66. Historical emissions (to 2020) and CH₄ emission projections – WEM scenario

Sector	CH ₄ emissions [kt]									
	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
1. Energy	952.26	907.05	933.81	841.52	717.62	578.98	452.62	380.62	317.82	271.58
A. Fuel combustion	137.84	168.11	141.74	155.71	116.29	90.76	75.50	63.31	52.08	41.96
1. Energy industries	0.65	0.70	0.73	1.06	1.24	1.35	1.32	1.30	1.20	1.15
2. Manufacturing industries and construction	3.07	3.27	3.87	4.84	4.87	4.65	4.45	4.37	4.30	4.30
3. Transport	5.81	5.18	4.89	3.60	3.46	2.96	2.70	2.40	2.20	2.01
4. Other sectors	128.31	158.96	132.25	146.22	106.72	81.80	67.04	55.23	44.38	34.51
B. Fugitive emissions from fuels	814.42	738.94	792.07	685.82	601.33	488.22	377.12	317.32	265.73	229.63
1. Solid fuels	719.82	651.44	690.01	579.09	491.34	375.08	266.98	213.64	169.96	141.07
2. Crude oil and natural gas	94.60	87.50	102.06	106.73	109.99	113.15	110.14	103.68	95.77	88.55
2. Industrial processes and product use	1.89	2.50	2.62	2.32	2.93	2.97	2.98	2.99	2.97	2.95
B. Chemical industry	1.39	2.03	2.02	1.91	2.47	2.53	2.58	2.63	2.63	2.64
C. Metal industry	0.50	0.46	0.60	0.40	0.46	0.44	0.40	0.37	0.33	0.30
3. Agriculture	534.26	532.84	539.19	566.85	554.74	597.95	577.56	601.23	594.16	596.48
A. Enteric fermentation	460.56	473.53	486.61	515.16	503.56	539.99	520.60	543.72	538.28	540.71
B. Manure management	72.93	58.47	51.62	50.59	50.15	56.90	55.89	56.43	54.89	54.76
F. Field burning of agricultural waste	0.77	0.85	0.95	1.10	1.03	1.06	1.07	1.08	0.98	1.01
4. Land Use, Land Use Change and Forestry (LULUCF)	1.33	0.51	1.35	2.11	0.95	1.04	0.98	0.99	1.00	0.99
5. Waste	360.76	263.30	165.14	131.74	124.53	110.54	102.32	93.82	86.69	80.30
A. Solid waste disposal	257.45	143.48	80.29	49.42	35.26	22.84	16.27	9.91	5.19	1.52
B. Biological treatment of solid waste	2.15	2.04	6.58	7.04	13.62	14.51	15.58	15.54	15.54	15.54
D. Wastewater treatment and discharge	101.16	117.78	78.27	75.28	75.66	73.19	70.48	68.37	65.95	63.23
Total (incl. LULUCF)	1 850.51	1 706.20	1 642.11	1 544.54	1 400.77	1 291.48	1 136.47	1 079.67	1 002.63	952.30
Total (excl. LULUCF)	1 849.17	1 705.69	1 640.76	1 542.43	1 399.81	1 290.44	1 135.49	1 078.68	1 001.63	951.31

Source: study by KOBIZE, IEP-NRI



Projected methane emissions gradually decrease from about 2.5 Mt in 1990 to nearly 1.3 Mt CH₄ in 2030 (a 48% decrease) and to less than 1 Mt CH₄ in 2050 (a 62% decrease) (excluding LULUCF). The share of methane in national emissions is projected to increase from 13% in 2030 to 18% in 2050.

The largest expected reduction in CH₄ emissions since 1990 occurred in the Waste sector, by 82% in 2030 and by 87% in 2050, due to a projected reduction in waste managed in landfills (including a reduction in biodegradable waste) and an increase in the management of sewage sludge from municipal wastewater treatment plants.

A decrease in CH₄ emissions since 1990 is also projected in the Energy sector, primarily in fugitive emissions: by 45% in 2030 and 74% in 2050, mainly due to a further decline in coal mining. In the case of agriculture, despite a significant reduction in methane emissions since 1990: by 31% by 2030, CH₄ emissions are projected to fluctuate in the following years until 2050, mainly driven by changes in livestock populations.

Table 67. Historical emissions (to 2020) and N₂O emission projections – WEM scenario

Sector	N ₂ O emissions N ₂ O [kt]									
	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
1. Energy	8.91	8.20	7.88	9.25	8.53	7.48	6.54	5.91	6.20	6.66
A. Fuel combustion	8.91	8.20	7.88	9.25	8.53	7.48	6.54	5.91	6.19	6.66
1. Energy industries	2.61	2.69	2.60	2.19	2.07	1.52	1.04	0.88	0.68	0.63
2. Manufacturing industries and construction	0.44	0.46	0.54	0.66	0.67	0.63	0.60	0.59	0.58	0.58
3. Transport	1.72	1.74	1.71	2.29	2.30	2.15	1.97	1.76	2.51	3.27
4. Other sectors	4.14	3.31	3.02	4.11	3.50	3.17	2.92	2.68	2.42	2.18
B. Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Crude oil and natural gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Industrial processes and product use	15.29	4.15	2.62	1.84	2.17	2.18	2.20	2.22	2.22	2.23
B. Chemical industry	14.87	3.71	2.18	1.39	1.71	1.71	1.72	1.73	1.73	1.74
G. Other product manufacture and use	0.43	0.44	0.44	0.45	0.46	0.47	0.48	0.49	0.49	0.49
3. Agriculture	57.01	58.94	58.49	63.10	62.19	62.55	61.60	61.84	61.69	61.84
B. Manure management	8.90	8.75	8.66	9.93	9.86	10.33	10.12	10.42	10.55	10.67
D. Agricultural soils	48.08	50.16	49.79	53.13	52.29	52.18	51.44	51.37	51.10	51.13
F. Field burning of agricultural waste	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
4. Land Use, Land Use Change and Forestry (LULUCF)	3.52	3.37	6.44	6.67	6.41	6.09	5.66	2.61	2.59	2.59
5. Waste	2.58	2.67	2.95	3.06	3.36	3.39	3.40	3.34	3.27	3.20
B. Biological treatment of solid waste	0.13	0.12	0.39	0.42	0.82	0.87	0.93	0.93	0.93	0.93
C. Incineration and open burning of waste	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
D. Wastewater treatment and discharge	2.43	2.54	2.54	2.61	2.53	2.50	2.45	2.39	2.32	2.25
Total (incl. LULUCF)	87.31	77.34	78.37	83.91	82.67	81.70	79.41	75.91	75.97	76.53
Total (excl. LULUCF)	83.80	73.96	71.93	77.24	76.26	75.61	73.74	73.30	73.38	73.94

Source: study by KOBIZE, IEP-NRI

For N₂O, projected emissions (excluding LULUCF) will decrease from 105 kt in 1990 to nearly 76 kt (28% decrease) in 2030 and to 74 kt in 2050 (30% decrease). The share of nitrous oxide in national emissions will increase from 7% in 2030 to 13% in 2050.

The largest reduction in N₂O emissions between 1990 and 2050 was recorded in the Industrial Processes and Product Use sector (mainly in the chemical industry) by 82%. In the Agriculture sector, on the other hand, N₂O emissions decreased by 26%, with a 24% reduction already achieved by 2020. Agriculture is the most significant source of N₂O emissions in Poland, particularly agricultural soils. The Waste sector, on the other hand, has seen a 29% increase in N₂O emissions between 1990 and 2050 (2.5 kt to 3.2 kt), driven by a projected increase in the amount of municipal waste, industrial waste, medical waste and municipal sewage sludge thermally transformed and an increase in the amount of waste treated in composting plants.

Projected emission changes in the EU ETS and non-ETS sectors are shown in Table 68. GHG emissions from the part of sources covered by the EU ETS include the power and heating sector and some industrial plants. GHG emissions reported by EU ETS installations are projected to decrease significantly: from 192 Mt CO₂ eq in 2021 to 117 Mt CO₂ eq in 2030 (a 39% decrease) and to 33 Mt CO₂ eq in 2050 (an 83% decrease). At the same time, the share of GHG emissions from EU ETS installations in national emissions is projected to decrease – from the current 48% to 41% in 2030 and 22% in 2050.

In contrast, GHG emissions from sectors not covered by the EU ETS, or ESR, for 2021 were below the annual emissions allocated to Poland for that year. Projected emissions in the ESR decrease after 2021, but at a much slower rate than emissions in the ETS: by 21% by 2030 and by 46% by 2050. Thus, projected emissions in the ESR in 2030 will be 165 Mt CO₂ eq and will achieve a reduction of -14.3% from base year 2005 emissions (Table 68).

Table 68. Historical emissions (2021) and GHG emissions projections by EU ETS and non-ETS – WEM scenario [kt CO₂ eq]

Parameter	2021	2025	2030	2035	2040	2045	2050
ETS emissions	192 032.91	162 841.13	116 997.95	81 843.85	62 353.45	45 578.75	32 741.74
ESR emissions	207 851.06	185 331.62	164 951.08	147 055.41	133 557.60	121 648.87	113 241.79

Source: study by KOBIZE, IEP-NRI

When considering current projections of GHG fluxes, it can be assumed that the LULUCF sector accounts for the 2021–2025 period, based on the ‘with existing activities’ scenario, will show a surplus of credits required to meet the ‘no debit’ rule (as defined in Article 4(1) of the Regulation (EU) 841/2018) of approximately 16,695 kt CO₂ eq. It should be added that, for the 2026–2030 commitment period, each EU MS is expected to ensure that the sum of its GHG emissions and removals reported in 2032 for 2030 and earlier years, compared to the average of the GHG inventory data for 2016, 2017 and 2018, does not exceed the target set for that MS in column C of Annex IIa. For the 2026–2030 accounting period, the total assumed deficit of credits required to meet the sectoral LULUCF target (as set out in Article 4(3) of the Regulation (EU) 841/2018) will be around 11,013 kt CO₂ eq on average per year (total of 55,067 kt CO₂ eq). Significantly, the dimension of the possibly made available flexibility in this respect is 11,250 kt CO₂ eq. Taking into account the possible use of this flexibility, the assumed deficit of credits required to comply with the so-called ‘no debit’ principle (as defined in Article 4(1) of the Regulation (EU) 841/2018) will be reduced to a level of approx. 43,817 kt CO₂ eq for the period 2026–2030 (averaged annually over the period 2026–2030) this dimension will be 8,763 kt CO₂ eq.

6.3. Projections of GHG emissions and removals in the WAM scenario

6.3.1. Assumptions for the WAM scenario

Projections of GHG emissions to 2050 in the WAM scenario have been prepared using projections of activity change by sector, taking into account the IPCC source classifications, respectively, from the following data sources (Table 69).

Table 69. Data sources for activity change projections – WAM scenario

Sector	Main source of data	Additional sources of data/remarks
1. Energy	Projections of changes in activity in selected sectors, prepared by ARE SA for the preparation of the NECP 2024 report, included below.	Information obtained from industry organisations, industry studies and articles, etc. Statistics Poland projections
2. Industrial processes and product use		
3. Agriculture	Projections of activity changes for specific sectors of the economy, developed by the Institute of Environmental Protection – National Research Institute for the preparation of GHG and air pollutant emission projections, included in the report 'Projections of activity changes in selected sectors of the economy until 2040', December 2021.	Forecast of the agricultural sector activity in Poland until 2050 for the needs of KOBiZE, IEP-NRI; Institute of Agricultural and Food Economics – National Research Institute. Edited by PhD Konrad Prandecki. Warsaw, 6.05.2024.
4. Land Use, Land Use Change and Forestry (LULUCF)		Phase report of the project 'Importance of forests and land with forest vegetation in CO ₂ removal and storage in the framework of the new EU Forest Strategy for 2030 and the 'Fit for 55' package of acts.
5. Waste		National Waste Management Plan 2028 (NWMP 2028), Ministry of Climate and Environment 2023; Population forecast for 2023-2060, Statistics Poland 2023

Source: study by KOBiZE, IEP-NRI

Table 70 shows the historical and projected primary and final energy consumption (including non-energy consumption) in the country for the WAM scenario. The data provided shows a moderate decline in the country's primary energy demand between 2020 and 2030 from 103.3 Mtoe to 88.3 Mtoe in 2030 and then a further gradual decline in subsequent periods. Consequently, primary energy demand falls to 85.5 Mtoe in 2040 and 83.7 Mtoe in 2050. Final energy consumption falls over the period under consideration from 77.1 Mtoe to 69.7 Mtoe in 2030 and then to 63.9 Mtoe in 2040 and 58.4 Mtoe in 2050.

Table 70. Total primary and final energy consumption (historical to 2020 and projected from 2025 onwards) – WAM scenario [ktoe]

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Primary energy consumption*	92 905	101 819	96 061	103 280	101 108	88 338	82 744	85 454	84 930	83 660
Primary energy consumption	92 582	101 604	95 868	102 979	100 720	87 898	82 278	84 961	84 408	83 108
Final energy consumption*	61 700	70 380	65 169	77 134	75 501	69 733	66 383	63 936	61 179	58 393
Final energy consumption	57 473	65 250	60 863	70 257	70 040	64 373	61 109	58 789	56 257	53 854

*with non-energy consumption

Source: ARE S.A. own study (STEAM-PL, MESSAGE-PL), Eurostat

The final energy consumption in total and by sectors is presented in Table 71.

Table 71. Final energy consumption by sectors, excluding non-energy consumption (historical to 2020 and projected from 2025) – WAM scenario [ktoe]

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Industry	14 616	13 498	14 097	15 921	15 655	14 515	14 104	13 699	13 292	12 938
Transport	12 223	17 187	16 561	21 779	23 211	21 412	19 834	18 294	16 675	15 121
of which: passenger	No data	No data	8 985	11 002	12 247	10 840	10 328	9 746	9 087	8 439
freight	No data	No data	7 496	10 695	10 880	10 485	9 419	8 461	7 501	6 595
special vehicles	No data	No data	79	82	84	86	87	87	87	87
Households	19 467	22 002	19 032	21 101	19 616	17 102	16 221	16 246	16 053	15 874
Services	6 730	8 833	7 842	7 565	7 918	7 871	7 645	7 417	7 287	7 141
Agriculture	4 438	3 730	3 330	3 869	3 640	3 473	3 305	3 133	2 949	2 781
TOTAL	57 473	65 250	60 863	70 235	70 040	64 373	61 109	58 789	56 257	53 854

Source: ARE S.A. own study (PL-PL), Eurostat

Final energy consumption (excluding non-energy consumption) falls from 70.2 Mtoe to 64.4 Mtoe between 2020 and 2030. At the end of the projection, it reaches 53.9 Mtoe. Final consumption is assumed to decrease between 2020 and 2050 in all sectors of the national economy.

Table 72 shows final energy consumption by fuel.

Table 72. Final energy consumption by fuel and carrier (historical to 2020 and projected from 2025) – WAM scenario [ktoe]

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Electricity	9 028	10 206	10 990	11 806	12 615	13 128	13 987	15 148	16 114	16 841
District heating	6 634	6 547	5 462	5 603	5 570	4 967	4 517	4 374	4 263	4 103
Coal	12 340	13 733	11 218	9 335	6 253	3 362	1 844	1 033	547	168
Petroleum products	17 563	20 213	18 647	24 384	24 436	21 717	19 363	16 659	14 114	11 845
Natural gas	7 917	8 884	8 490	9 236	9 960	8 568	6 982	5 448	4 029	2 911
Biogas	40	48	78	92	228	455	817	903	991	1 081
Solid biomass	3 755	4 306	4 639	7 447	6 816	6 123	5 905	5 579	5 106	4 664
Biofuels	47	867	653	1 040	1763	1799	1742	1689	1527	1380
Municipal and industrial waste	136	378	486	889	894	915	933	954	978	1 006
Solar collectors, heat pumps, geothermal	12	69	200	404	1 465	2 265	3 012	3 929	4 670	5 343
Hydrogen	0	0	0	0	6	50	187	642	1 124	1 603
Biomethane	0	0	0	0	35	1 025	1 820	2 430	2 793	2 911
TOTAL	57 473	65 250	60 863	70 235	70 040	64 373	61 109	58 789	56 257	53 854

Source: ARE S.A. own study (PL-PL), Eurostat

There are gradual changes in the fuel mix in final energy consumption, with a significant decrease in coal consumption (its share decreases from 13% in 2020 to 5% in 2030 and to zero in 2050). The decline in coal consumption is mainly related to the slow but gradual process of modernisation of production facilities (in the industrial sector), partly due to the operation of the ETS, resulting in a shift to fuels and carriers such as RES or electricity. Subsequently, the process of replacing old, inefficient boilers in households, supported by subsidies (e.g., from the Clean Air Programme), will also influence the decrease in coal consumption. These processes are enforced e.g., by anti-smog resolutions introduced at regional level, which prohibit the use of solid fuel boilers. In the WAM scenario, the consumption of electricity and energy from renewable sources increases significantly, which is a characteristic trend observed in economies undergoing energy transition. Natural gas consumption in the 2030 horizon will increase, after which its share in final energy consumption will gradually decrease, as the fuel

emitting greenhouse gases will be gradually replaced by RES. A gradual decline in demand for district heating is also anticipated. This is due to assumptions about large-scale thermal modernisation measures and an increase in the use of heat pumps in individual heating systems.

The gross domestic consumption of individual fuels and energy carriers is shown in Table 73.

Table 73. Gross domestic consumption of fuels and energy (historical to 2020 and projected from 2025 onwards) – WAM scenario [ktoe]

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Electricity	12 532	13 440	14 154	14 730	15 346	16 095	19 161	25 701	29 512	32 531
District heating	8 032	8 021	6 721	6 843	6 761	6 100	5 561	5 379	5 213	5 024
Hard coal	37 651	39 774	31 248	28 188	23 353	12 183	6 526	1 653	432	93
Coking coal	7 891	8 700	9 489	7 997	7 492	7 487	7 519	7 574	7 505	7 444
Coke	2 318	2 074	2 228	1 308	1 347	1 246	1 169	1 104	1 069	1 039
Lignite	12 726	11 579	12 299	8 850	7 109	2 624	715	6	3	1
Crude oil	18 459	23 184	26 506	25 992	24 294	22 812	21 439	19 696	17 716	15 874
Petroleum products	21 987	25 956	24 074	31 037	31 318	28 339	25 728	22 842	19 839	12 755
Natural gas	12 235	12 805	13 776	17 107	18 517	17 949	14 959	9 662	5 642	2 710
Coke oven gas	1 447	1 707	1 704	1 406	1 285	1 149	1 078	1 000	891	847
Blast furnace gas	560	526	632	464	604	427	217	107	69	48
Other gaseous fuels	161	149	163	84	93	73	60	41	16	5
Solid biomass	4 166	5 866	6 884	9 330	8 944	8 646	8 126	7 852	7 441	7 583
Biogas	54	115	229	322	600	855	957	1 323	1 522	1 752
Biofuels	54	868	782	1 042	1 763	1 799	1 742	1 689	1 528	1 382
Biomethane	0	0	0	0	131	1 374	2 519	3 483	4 132	4 570
Nuclear fuel	0	0	0	0	0	0	2 106	13 308	17 134	17 846
Hydrogen	0	0	0	0	7	184	1 457	4 374	5 887	7 419
Municipal and industrial waste	157	400	564	1 193	1 357	1 506	2 472	2 558	2 403	2 415

Source: ARE S.A. own study (STEAM-PL, MESSAGE-PL), Eurostat

The following conclusions can be drawn from the data presented in Table 73:

- the growth in domestic electricity consumption between 2020 and 2030 will be 30%, and between 2020–2050 – 121%. The average annual growth rate of this category is 2.7% throughout the forecast period under consideration. Electricity consumption will increase in all sectors, with the most significant increases in the transport, heating and industry sectors. In the transport sector, electricity consumption in road transport (electromobility) is expected to increase primarily. The projection assumes that by 2030 there will be about 950,000 thousand and in 2050 about 9.4 million electrically powered vehicles on Polish roads, consuming respectively: 2.8 TWh and 21.8 TWh of electricity. In district heating, a significant share of centralised systems based on large-scale heat pumps is assumed, the operation of which involves significant electricity consumption. The same applies to individual heat sources, where heat pumps will play a key role. The increase in industrial electricity consumption will be mainly associated with the modernisation and automation of production facilities. As a result of the energy transition process, solid fuels will gradually be replaced in the initial period partly by natural gas and then by technical solutions using electricity; At the same time, processes of improving the energy efficiency of equipment using electricity (electric drives, technological systems) will take place in industry, which will have an impact on reducing energy consumption;

- a decrease in demand for district heating is projected (by 11% in 2020—2050), resulting from assumptions regarding the rate and scope of thermo-modernisation of buildings, the rate and scope of connection of new consumers and market conditions. The projection assumes that measures taken to combat so-called low emissions will become an incentive to invest in the development of district heating networks; at the same time, the assumed increase in CO₂ emission allowance prices will cause system heat, especially in the initial period of the projection, to gradually lose its competitiveness in comparison with individual heating technologies.
- a decrease in coal and lignite consumption resulting from energy transition processes is projected. The decline in coal consumption in the electricity and district heating sector will significantly accelerate already after 2028, when the capacity market for most coal-fired units will end. Coal consumption in buildings will drop to almost zero by 2040. In the above-mentioned sectors, there are only trace amounts of coal consumption that will remain after this period;
- consumption of crude oil and petroleum products is expected to decrease over the analysed period. The increase in the consumption of petroleum products observed between 2015 and 2020 was related to the introduction of a package of laws in Poland limiting the so-called grey market in fuel trading. A gradual reduction in the use of traditional motor fuels and their replacement by alternative fuels is assumed. An important role is also played by the improvement of energy efficiency, including a gradual decrease in the unit fuel consumption rates of new vehicles, in line with the assumptions of EU legislation, as well as the growing importance of electromobility and biofuels;
- analysis results indicate a slight increase in domestic demand for natural gas in the 2030 perspective (from 17.1 Mtoe in 2020 to 17.9 Mtoe), followed by a gradual decline to 2.7 Mtoe in 2050. Natural gas in Poland will play the role of a transition fuel in the energy transition, but only in the initial 10-15 year period. Thereafter, it will be gradually replaced by zero-emission fuels and technologies;
- a further gradual increase in demand for renewable energy carriers such as biomass, biogas or biofuels is expected.
- biomethane will play an important role in the energy mix, with consumption estimated at 1.4 Mtoe in 2030 and a gradual increase to 4.6 Mtoe by 2050.

Table 74 presents data on gross electricity and district heat production in Poland.

Table 74. Gross electricity and district heat production (historical to 2020 and projected from 2025) – WAM scenario

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Electricity [GWh]	157 295	158 186	165 128	158 247	180 213	192 604	228 257	307 923	353 834	388 940
District heating [TJ]	336 292	335 831	274 357	285 870	280 425	251 724	229 116	221 327	214 365	207 908

Source: ARE S.A. own study (STEAM-PL, MESSAGE-PL), Eurostat

Electricity production by fuel is shown in Table 75.

Table 75. Gross electricity production (historical to 2020 and projected from 2025) – WAM scenario [TWh]

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Lignite	54.8	48.7	52.8	38.1	31.2	11.4	3.0	0.0	0.0	0.0
Hard coal*	88.5	89.3	79.4	70.7	64.6	31.9	16.5	4.1	0.0	0.0
Gaseous fuels**	5.2	5.1	6.4	17.4	23.4	30.8	26.9	9.3	2.6	0.0
Fuel oil	2.7	2.6	2.1	1.7	1.8	1.4	1.2	0.9	0.0	0.0
Nuclear energy	0.0	0.0	0.0	0.0	0.0	0.0	9.5	58.1	74.9	78.5
Biomass	1.4	5.9	9.0	6.9	6.8	7.9	7.4	7.5	9.4	12.8
Biogas	0.1	0.4	0.9	1.2	2.2	3.2	3.5	4.8	5.4	6.3
Hydro power	2.2	2.9	1.8	2.1	2.6	2.9	3.0	3.0	3.1	3.2
From pumped water	1.6	0.6	0.6	0.8	1.2	3.9	3.9	6.6	7.7	7.7
Onshore wind energy	0.1	1.7	10.9	15.8	28.6	47.4	59.2	69.5	79.5	90.7
Offshore wind energy	0.0	0.0	0.0	0.0	0.0	21.7	45.5	67.4	80.9	93.9
Solar energy	0.0	0.0	0.1	2.0	15.3	24.6	33.9	43.1	52.8	55.7
Geothermal energy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydrogen	0.0	0.0	0.0	0.0	0.0	0.0	6.9	17.8	18.7	19.4
Other***	0.7	1.1	1.0	1.5	2.5	2.4	2.2	2.5	1.0	0.7
Energy storage (batteries)	0.0	0.0	0.0	0.0	0.0	3.1	5.7	13.5	17.6	20.1
Total	157.3	158.2	165.1	158.2	180.2	192.6	228.3	307.9	353.8	388.9

* Including coke oven gas and blast furnace gas

** High-methane and nitrogen-rich natural gas, gas from mine de-methanation, associated petroleum gas

*** Inorganic industrial and municipal waste

Source: ARE S.A. own study (MESSAGE-PL), Eurostat

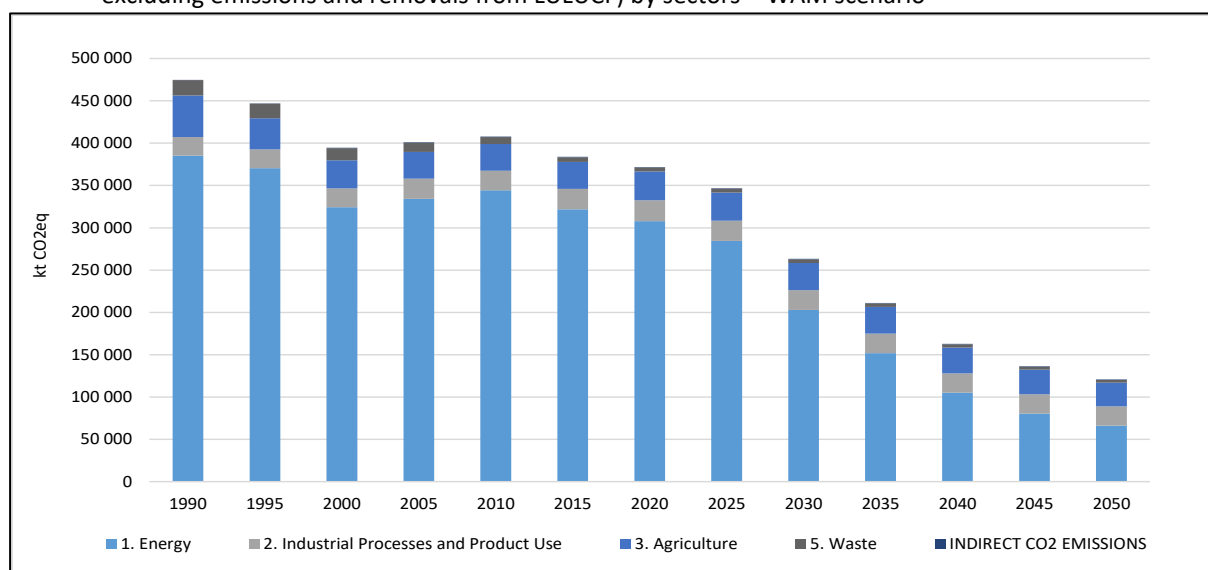
6.3.2. Projection results in the WAM scenario

The aggregated results of projected for 2025-2050 GHG emissions and removals in Poland for the WAM scenario are presented below (Table 76, Fig. 40), compared with historical emissions for 2005-2020, by IPCC sectors and gases (Table 76).

Table 76. Historical emissions (up to 2020) and projected GHG emissions (from 2025 onwards) by sectors – WAM scenario

Sector	GHG emissions [kt CO ₂ eq]									
	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
1. Energy	334 317.08	344 423.02	321 729.78	307 991.99	284 421.00	202 926.83	151 998.65	105 338.90	80 488.92	66 292.55
2. Industrial processes and product use	23 732.01	22 878.65	24 351.84	24 516.29	24 042.67	23 526.81	22 993.36	22 650.89	22 751.39	22 846.74
3. Agriculture	31 659.42	31 659.66	31 705.48	34 051.67	33 111.96	32 093.93	31 582.27	30 483.55	29 232.54	27 902.20
4. Land Use, Land Use Change and Forestry (LULUCF)	-48 018.52	-32 962.30	-29 143.46	-18 957.85	-45 472.75	-42 083.00	-35 235.54	-29 984.47	-25 952.60	-19 755.99
5. Waste	11 000.17	8 275.63	5 608.23	4 752.48	4 652.44	4 268.70	4 041.42	3 786.22	3 568.86	3 372.02
Indirect CO ₂ emissions	564.93	567.87	546.19	582.52	545.78	539.97	531.84	523.60	520.79	518.42
Total (incl. LULUCF)	353 255.10	374 842.53	354 798.06	352 937.10	301 301.10	221 273.24	175 912.01	132 798.69	110 609.90	101 175.93
Total (excl. LULUCF)	401 273.62	407 804.83	383 941.52	371 894.95	346 773.85	263 356.24	211 147.55	162 783.15	136 562.50	120 931.92
CO ₂ emissions from biomass	19 802.69	30 378.55	34 917.41	48 969.63	49 328.74	48 782.32	46 405.01	46 207.40	43 695.61	44 400.20

Source: study by KOBIZE, IEP-NRI

Fig. 40. Historical emissions (1990–2020) and GHG emission projections (including indirect CO₂ emissions and excluding emissions and removals from LULUCF) by sectors – WAM scenario

Source: study by KOBIZE, IEP-NRI

Table 77. Historical emissions (up to 2020) and projected GHG emissions (from 2025 onwards) by gas – WAM scenario

Sector	GHG emissions [kt CO ₂ eq]									
	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
CO ₂	323 329.98	334 792.45	313 261.61	303 019.61	283 952.40	208 105.45	161 079.71	117 703.13	94 262.82	80 988.96
CH ₄	51 776.88	47 759.43	45 941.23	43 188.11	40 175.33	34 317.69	30 458.17	26 884.53	24 969.66	23 745.59
N ₂ O	22 206.21	19 600.62	19 062.05	20 469.86	19 291.60	18 297.54	17 690.90	16 803.20	15 937.71	14 805.07
HFCs	3 761.45	5 598.16	5 583.52	5 114.48	3 217.85	2 535.00	1 828.70	1 311.52	1 311.52	1 311.52
PFCs	171.47	17.72	13.71	10.61	8.21	6.35	4.92	3.80	3.80	3.80
SF ₆	27.62	36.45	79.39	92.29	128.46	94.21	85.16	76.98	76.98	76.98
NF ₃	-	-	-	-	-	-	-	-	-	-
Total (excl. LULUCF)	401 273.62	407 804.83	383 941.52	371 894.95	346 773.85	263 356.24	211 147.55	162 783.15	136 562.50	120 931.92

Source: study by KOBIZE, IEP-NRI

It is projected that national GHG emissions (excluding the LULUCF sector) for the WAM scenario will be 263.4 Mt CO₂ eq in 2030 and 120.9 Mt CO₂ eq in 2050, decreasing by more than 44% in 2030 and by more than 74% in 2050 compared to 1990. In the energy sector, emission reductions will be 47% in 2030 and 83% in 2050. The main factor reducing GHG emissions in the energy sector is the decrease in fuel consumption in both stationary and mobile sources. A reduction in GHG emissions is also observed in the waste sector (by 76% in 2030 and by 81% in 2050). In the agricultural sector, the reduction in GHG emissions will be 35% in 2030 and 43% in 2050 compared to 1990, mostly influenced by the reduction in cattle and mineral fertiliser use. For the industrial processes and product use sector, emissions are projected to increase slightly by 7% in 2030 and 4% in 2050 compared to 1990.

A very large reduction in GHG emissions from fuel combustion is predicted over the projection years, amounting to near 35% in the period 2020–2030 and more than 75% by 2050. The largest impact on this reduction is the reduction in GHG emissions in category 1A1a Electricity and heat production. The projected decrease in this category will be almost 48% by 2030 and more than 99% by 2050, compared to 2020. This is due to the reduction in fossil fuel use in this sector – by 2030, the use of hard coal is expected to decrease by more than 52%, lignite by more than 70%, and by 2050, a complete phase-out of the use of these fuels is expected. The use of BECCC (Bio-Energy with Carbon Capture and

Storage) to reduce CO₂ emissions is also assumed from 2044. A significant decrease in GHG emissions is also projected in category 1A4b Households, by around 48% between 2020 and 2030, and by 2050 – by more than 83%. For this sector, such a significant reduction is also linked to a decrease in fuel consumption (mainly hard coal) of 65% by 2030 and the complete replacement of this fuel by other energy carriers by 2050.

In the LULUCF sector, carbon accumulation (CO₂ removal) is projected to increase in the short term, from over 20 Mt CO₂ eq today to a value of about 47.7 Mt CO₂ eq in 2028. However, in the longer term, carbon accumulation is expected to decrease to about 42.1 Mt CO₂ eq in 2030 and less than 20 Mt CO₂ eq in 2050. It is worth noting that the net balance of the LULUCF sector is directly correlated to the net balance of emissions from managed forest land. Long-term forecasts for this category and in this respect point to a significant decline in carbon accumulation, due to a reduction in the growth rate of tree stocks as a result of climate and habitat changes and progressive ageing of forest stands.

Another important factor is the increased process of deadwood generation, caused by the gradual weakening of stands, as a result of which they become increasingly susceptible to primary and secondary pests. This condition should also be linked to ongoing climate change and, in particular, water scarcity during the growing season. In this context, it is worth highlighting policies and measures that promote the leaving of dead wood in forests to support biodiversity. Particular attention should be paid to the implementation of the National Policy on Forests⁷⁵ which assumes, in its technological component on forest management activities, to leave in each stand, intended for regeneration by cutting, a part of old trees (from 5 to 10%) until their physiological old age or biological death, including hollow and dead trees – as habitats for numerous species of forest biocenoses.

It should be noted that in the WAM scenario, the model simulations follow a two-pronged approach. Their main scope is still based on the continuation of the principles of the silvicultural model of forest productivity for stands where no harvesting restrictions have been and are planned. This approach covers both stands under the management of the State Forests National Forest Holding and forests of other forms of ownership.

In both of these cases, no differences are assumed in the intensity of use, its structure in age classes and subclasses. As a result, for the indicated forest area, the values of the projected net harvesting based on the use of historical indicators of the intensity of cutting and pre-cutting (quantifying the level of implementation of these specific forest management practices), determined for 2010–2019, were used, assigned to the changing species-age structure of the stands due to their ageing.

The process of modelling the carbon stock change balances for the remaining forest land departs from the assumption of maintaining the current level and intensity of cutting and pre-cutting in the age classes and subclasses defined in 2010-2019. In the WAM scenario, timber harvesting in 2030 will be reduced by 13% compared to the WEM scenario. The indicated level of harvest reduction (the driver of the final magnitude of change in carbon stocks) allows for the achievement of such a net removal value, which is provided for in the removal enhancement target for Poland for 2030, described in column C of Annex IIa of the Regulation 2018/841. The indicated target forces an increase in the sector's reported level of carbon accumulation by 3.278 kt CO₂ eq compared to the average data from the GHG inventories for 2016, 2017 and 2018.

⁷⁵ National Policy on Forests 1997. Document adopted by the Council of Ministers on 22 April 1997. Ministry of Environmental Protection, Natural Resources and Forestry, Warsaw.

In the remaining stands (i.e. restricted stands), the simulations are based on the use of the stand limit productivity model, that is, the complete omission of both cutting and pre-cutting. As a result of including the stand productivity limit model, a short-term positive effect of eliminating previously implemented management practices such as pre-cutting in observed changes in carbon stocks is noted. In this case, special attention was paid to the protective functions of about 20% of the most valuable forest areas managed by State Forests National Forest Holding. These areas, which are considered to be naturally valuable and socially important, can be the subject of specific regulations on the conditions of forest management aimed at their protection and preservation of biodiversity with the aim of sustainable forest management, which combines production functions with important environmental protection objectives.

The following tables (Tables 78, 79 and 80) present the results of the projected GHG emissions for 2025-2050 in Poland by sector and subsector, compared with emissions in 2005-2020, by gas.

Table 78. Historical emissions (to 2020) and CO₂ emission projections – WAM scenario [kt CO₂]

Sector	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
1. Energy	305 292.48	316 852.23	293 495.67	281 978.11	261 611.94	185 594.64	138 352.93	94 823.83	71 313.87	58 015.54
A. Fuel combustion	301 905.38	313 363.43	288 748.81	277 753.06	257 329.38	181 228.03	133 955.39	90 418.16	66 942.95	53 672.43
1. Energy industries	177 651.35	172 795.91	162 990.16	138 993.06	127 832.44	74 928.63	44 861.52	16 610.85	6 198.59	3 960.82
2. Manufacturing industries and construction	33 669.65	29 402.61	27 703.78	28 596.72	26 864.41	20 826.84	16 632.76	12 570.66	9 466.72	7 225.47
3. Transport	35 631.64	48 767.04	47 449.35	62 374.76	64 153.12	57 178.47	50 954.39	43 747.18	36 847.99	30 626.68
4. Other sectors	54 952.74	62 397.88	50 605.53	47 788.52	38 479.40	28 294.09	21 506.72	17 489.48	14 429.66	11 859.46
B. Fugitive emissions from fuels	3 387.10	3 488.80	4 746.86	4 225.05	4 282.56	4 366.61	4 397.54	4,405.68	4,370.92	4 343.10
1. Solid fuels	2 225.64	2 424.68	2 712.17	2 340.89	2 087.61	2 094.51	2 110.93	2 132.85	2 117.46	2 104.21
2. Crude oil and natural gas	1 161.46	1 064.11	1,034.69	1 884.16	2 194.95	2 272.10	2 286.61	2 272.83	2 253.46	2 238.89
2. Industrial processes and product use	15 665.47	16 056.87	17 907.27	18 746.13	20 033.42	20 231.36	20 409.61	20 588.19	20 686.71	20 780.05
A. Mineral industry	8 355.79	9 849.54	10 088.59	11 738.98	12 675.14	12 881.64	13 073.52	13 260.82	13 379.56	13 491.25
B. Chemical industry	4 886.78	4 335.42	5 141.13	4 866.96	5 030.36	5 081.79	5 128.55	5 176.50	5 198.51	5 220.29
C. Metal industry	2 236.00	1 639.16	2 419.96	1 824.37	1 997.16	1 938.74	1 881.67	1 829.70	1 796.31	1 764.78
D. Non-energy products from fuels and solvent use	186.90	232.76	257.59	315.82	330.77	329.20	325.87	321.18	312.34	303.72
3. Agriculture	1 591.35	1 121.19	1 108.98	1 458.75	1 486.70	1 464.91	1 510.76	1 492.95	1 466.89	1 400.40
G. Liming	944.90	391.55	373.84	836.30	914.83	944.22	1 020.94	1 052.80	1 076.93	1 095.02
H. Urea application	394.18	467.17	471.24	431.33	502.13	457.96	436.71	392.99	352.83	276.30
I. Other C containing fertilisers	252.27	262.46	263.89	191.13	69.74	62.73	53.11	47.16	37.14	29.08
4. Land Use, Land Use Change and Forestry (LULUCF)	-48 987.35	-33 870.34	-30 886.90	-20 783.76	-47 195.04	-43 722.49	-36 760.35	-30 700.61	-26 663.38	-20,466.43
5. Waste	215.76	194.29	203.50	254.10	274.56	274.56	274.56	274.56	274.56	274.56
C. Incineration and open burning of waste	215.76	194.29	203.50	254.10	274.56	274.56	274.56	274.56	274.56	274.56
Indirect CO ₂ emissions	564.93	567.87	546.19	582.52	545.78	539.97	531.84	523.60	520.79	518.42
Total (incl. LULUCF)	274 342.63	300 922.11	282 374.71	282 235.85	236 757.36	164 382.95	124 319.36	87 002.52	67 599.44	60 522.53
Total (excl. LULUCF)	323 329.98	334 792.45	313 261.61	303 019.61	283 952.40	208 105.45	161 079.71	117 703.13	94 262.82	80 988.96
CO ₂ emissions from biomass	19 802.69	30 378.55	34 917.41	48 969.63	49 328.74	48 782.32	46 405.01	46 207.40	43 695.61	44 400.20

Source: study by KOBIZE, IEP-NRI

CO₂ will remain the main greenhouse gas emitted in Poland. Its share in national emissions will be 79% in 2030 and 67% in 2050. CO₂ emissions are projected to decrease significantly from nearly 377 Mt CO₂ eq in 1990 to 208 Mt CO₂ eq in 2030 (a decrease of 45%) and to 81 Mt CO₂ eq in 2050 (a decrease of 79%). The most significant decrease in emissions is recorded in the Energy sector, due to a significant decrease in fuel consumption in stationary and mobile sources.

Table 79. Historical emissions (to 2020) and CH₄ emission projections – WAM scenario

Sector	CH ₄ emissions [kt]									
	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
1. Energy	952.26	907.05	933.81	841.52	734.11	550.56	427.26	322.37	280.58	252.29
A. Fuel combustion	137.84	168.11	141.74	155.71	119.14	88.10	72.29	60.71	49.50	39.99
1. Energy industries	0.65	0.70	0.73	1.06	1.28	1.38	1.24	1.43	0.72	0.62
2. Manufacturing industries and construction	3.07	3.27	3.87	4.84	4.75	4.28	4.06	3.99	3.94	3.95
3. Transport	5.81	5.18	4.89	3.60	3.61	3.11	2.82	2.43	2.13	1.86
4. Other sectors	128.31	158.96	132.25	146.22	109.50	79.33	64.16	52.86	42.71	33.56
B. Fugitive emissions from fuels	814.42	738.94	792.07	685.82	614.97	462.46	354.97	261.66	231.08	212.30
1. Solid fuels	719.82	651.44	690.01	579.09	503.18	351.91	250.81	168.80	146.84	139.39
2. Crude oil and natural gas	94.60	87.50	102.06	106.73	111.79	110.55	104.16	92.86	84.24	72.91
2. Industrial processes and product use	1.89	2.50	2.62	2.32	2.86	2.89	2.92	2.96	2.96	2.96
B. Chemical industry	1.39	2.03	2.02	1.91	2.47	2.53	2.58	2.63	2.63	2.64
C. Metal industry	0.50	0.46	0.60	0.40	0.39	0.36	0.35	0.33	0.32	0.32
3. Agriculture	534.26	532.84	539.19	566.85	573.34	561.63	555.29	541.01	521.55	512.51
A. Enteric fermentation	460.56	473.53	486.61	515.16	519.78	505.30	499.69	486.62	469.64	461.36
B. Manure management	72.93	58.47	51.62	50.59	52.42	55.27	54.54	53.37	50.94	50.25
F. Field burning of agricultural waste	0.77	0.85	0.95	1.10	1.14	1.06	1.05	1.02	0.98	0.90
4. Land Use, Land Use Change and Forestry (LULUCF)	1.33	0.51	1.35	2.11	0.85	0.93	0.88	0.89	0.90	0.89
5. Waste	360.76	263.30	165.14	131.74	124.53	110.54	102.32	93.82	86.69	80.30
A. Solid waste disposal	257.45	143.48	80.29	49.42	35.26	22.84	16.27	9.91	5.19	1.52
B. Biological treatment of solid waste	2.15	2.04	6.58	7.04	13.62	14.51	15.58	15.54	15.54	15.54
D. Wastewater treatment and discharge	101.16	117.78	78.27	75.28	75.66	73.19	70.48	68.37	65.95	63.23
Total (incl. LULUCF)	1 850.51	1 706.20	1 642.11	1 544.54	1 435.69	1 226.56	1 088.67	961.05	892.67	848.94
Total (excl. LULUCF)	1 849.17	1 705.69	1 640.76	1 542.43	1 434.83	1 225.63	1 087.79	960.16	891.77	848.06

Source: study by KOBIZE, IEP-NRI

Projected methane emissions gradually decrease from about 2.5 Mt in 1990 to nearly 1.2 Mt CH₄ in 2030 (a 51% decrease) and to less than 0.8 Mt CH₄ in 2050 (a 66% decrease) (excluding LULUCF). The share of methane in national emissions is projected to increase from 13% in 2030 to 20% in 2050. The largest expected reduction in CH₄ emissions since 1990 occurred in the Waste sector, by 82% in 2030 and by 87% in 2050, due to a projected reduction in waste managed in landfills (including a reduction in biodegradable waste) and an increase in the management of sewage sludge from municipal wastewater treatment plants.

A decrease in CH₄ emissions since 1990 is also projected in the Energy sector, primarily in fugitive emissions: by 45% in 2030 and 74% in 2050, mainly due to a further decline in coal mining. For

agriculture, a significant reduction in methane emissions since 1990 is projected: 35% by 2030 and 41% by 2050, driven primarily by changes in livestock populations.

Table 80. Historical emissions (to 2020) and N₂O emission projections – WAM scenario

Sector	N ₂ O emissions N ₂ O [kt]									
	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
1. Energy	8.91	8.20	7.88	9.25	8.51	7.23	6.35	5.62	4.98	4.58
A. Fuel combustion	8.91	8.20	7.88	9.25	8.50	7.23	6.35	5.62	4.98	4.58
1. Energy industries	2.61	2.69	2.60	2.19	2.06	1.33	0.88	0.62	0.48	0.56
2. Manufacturing industries and construction	0.44	0.46	0.54	0.66	0.65	0.58	0.55	0.54	0.54	0.54
3. Transport	1.72	1.74	1.71	2.29	2.28	2.17	2.01	1.79	1.55	1.30
4. Other sectors	4.14	3.31	3.02	4.11	3.52	3.14	2.90	2.67	2.41	2.17
B. Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Crude oil and natural gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Industrial processes and product use	15.29	4.15	2.62	1.84	2.17	2.18	2.20	2.22	2.22	2.23
B. Chemical industry	14.87	3.71	2.18	1.39	1.71	1.71	1.72	1.73	1.73	1.74
G. Other product manufacture and use	0.43	0.44	0.44	0.45	0.46	0.47	0.48	0.49	0.49	0.49
3. Agriculture	57.01	58.94	58.49	63.10	58.76	56.24	54.81	52.24	49.67	45.86
B. Manure management	8.90	8.75	8.66	9.93	9.45	9.33	9.32	9.20	9.01	8.96
D. Agricultural soils	48.08	50.16	49.79	53.13	49.26	46.87	45.44	42.99	40.61	36.86
F. Field burning of agricultural waste	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
4. Land Use, Land Use Change and Forestry (LULUCF)(LULUCF)	3.52	3.37	6.44	6.67	6.41	6.09	5.66	2.61	2.59	2.59
5. Waste	2.58	2.67	2.95	3.06	3.36	3.39	3.40	3.34	3.27	3.20
B. Biological treatment of solid waste	0.13	0.12	0.39	0.42	0.82	0.87	0.93	0.93	0.93	0.93
C. Incineration and open burning of waste	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
D. Wastewater treatment and discharge	2.43	2.54	2.54	2.61	2.53	2.50	2.45	2.39	2.32	2.25
Total (incl. LULUCF)	87.31	77.34	78.37	83.91	79.21	75.14	72.42	66.02	62.73	58.46
Total (excl. LULUCF)	83.80	73.96	71.93	77.24	72.80	69.05	66.76	63.41	60.14	55.87

Source: study by KOBIZE, IEP-NRI

For N₂O, projected emissions (excluding LULUCF) will decrease from 105 kt in 1990 to nearly 69 kt (a decrease of 34%) in 2030 and to 56 kt in 2050 (a decrease of 47%) (Table 80). The share of nitrous oxide in national emissions will increase from 7% in 2030 to 12% in 2050. The largest reduction in N₂O emissions between 1990 and 2050 will be in the Industrial Processes and Product Use sector (mainly in the chemical industry) by 82%. In the Agriculture sector, on the other hand, N₂O emissions will decrease from 1990 by 32% to 2030 and by 45% to 2050. Agriculture is the most significant source of N₂O emissions in Poland, especially agricultural soils. The largest impact on the decrease in N₂O emissions in this category will be projected reduction in mineral fertiliser use of 55% between 2020—2050. The Waste sector, on the other hand, will see an increase in N₂O emissions of 29% between 1990 and 2050 (2.5 kt to 3.2 kt), due to a predicted increase in the amount of municipal waste, industrial waste, medical waste and municipal sewage sludge thermally transformed and an increase in the amount of waste treated in composting plants.

Projected emission changes in the EU ETS and non-ETS sectors are shown in Table 80. GHG emissions from the part of sources covered by the EU ETS include the power and heating sector and some industrial plants. GHG emissions reported by EU ETS installations are projected to decrease significantly: from 192 Mt CO₂ eq in 2021 to 105.6 Mt CO₂ eq in 2030 (a 45% decrease) and to 24.5 Mt CO₂ eq in 2050 (an 88% decrease). At the same time, the share of GHG emissions from EU ETS installations in national emissions is projected to decrease – from the current 48% to 40% in 2030 and 19% in 2050.

At the same time, GHG emissions from sectors not covered by the EU ETS, or ESR, decrease after 2021, but at a much slower rate than emissions in the ETS: by 24% by 2030 and by 53% by 2050. Thus, projected emissions in the ESR in 2030 will be 157.4 Mt CO₂ eq and will achieve a reduction of -18.2% from base year 2005 emissions (Table 81).

Table 81. Historical emissions (2021) and GHG emissions projections (ETS and non-ETS) – WAM scenario

Parameter	2021	2025	2030	2035	2040	2045	2050
ETS emissions [kt CO ₂ eq]	192 032.91	162 132.65	105 620.65	73 274.06	43 411.48	29 376.43	23 462.97
ESR emissions [kt CO ₂ eq]	207 851.06	184 381.14	157 416.55	137 501.82	118 984.82	106 796.42	97 102.49

Source: study by KOBIZE, IEP-NRI

When considering the current GHG flux projections, it can be assumed that the LULUCF sector settlements over the period 2021-2025, based on the 'with additional measures' scenario, will show a surplus of credits required to meet the 'zero debit' rule (as defined in Article 4(1) of the Regulation (EU) 841/2018) of 37 Mt CO₂ eq (approx. 7.3 Mt CO₂ eq on average per year).

For the period 2026-2030, on the other hand, it can be assumed that the projected total surplus of credits required to meet the sectoral LULUCF target will be about 40 Mt CO₂ eq (about 8 Mt CO₂ eq on average per year). It is worth mentioning that these projections include additional measures to increase CO₂ removal and reduce GHG emissions. With these measures, the LULUCF sector will not only be able to meet the requirements placed on it but will also contribute to achieving the EU's 2030 climate targets. Achieving the projected dimension of surplus credits will have to be the result of effective forest management and the implementation of strategies that reduce emissions and increase CO₂ removal.

It should be added that during the 2026-2030 commitment period, each EU MS must ensure that the sum of its GHG emissions and removals reported in 2032 for 2030 and earlier years, compared to the average of the GHG inventory data for 2016, 2017 and 2018, does not exceed the target set for that MS in column C of Annex IIa.

6.4. Comparison of projected GHG emissions in the WEM and WAM scenarios

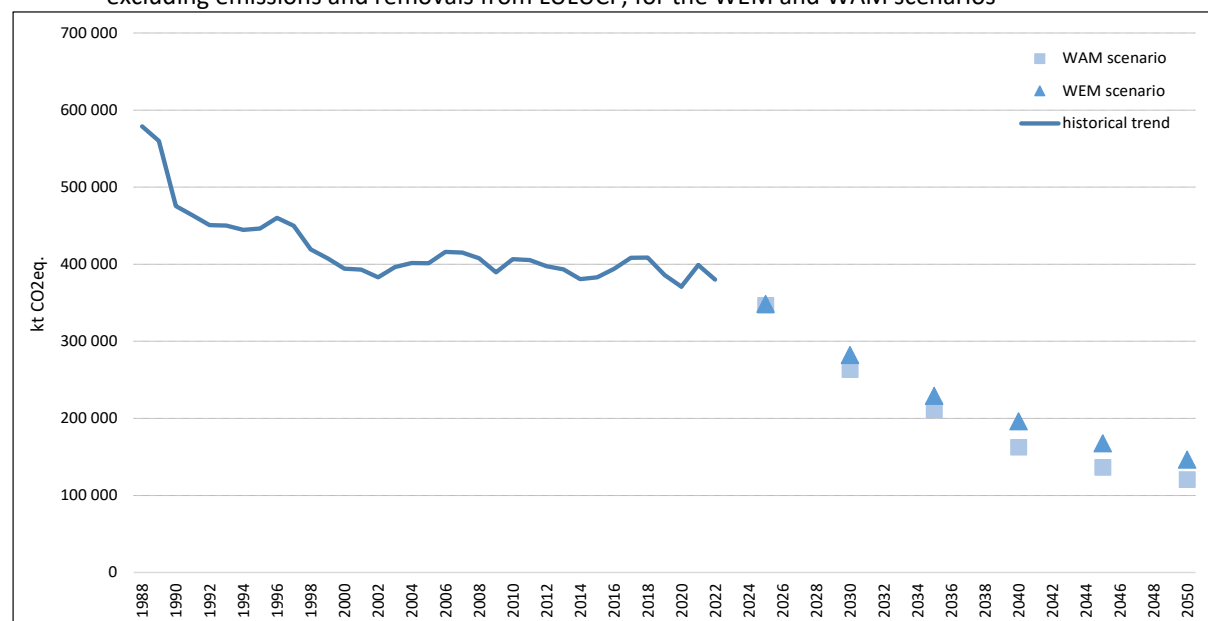
The results of a comparison of GHG emissions projections and removals, by IPCC sector, to 2050 for the WEM and WAM scenarios are presented in Table 82.

Table 82. Historical emissions (to 2020) and GHG emission projections for WEM and WAM scenarios, by sector

Sector	GHG emissions [kt CO ₂ eq]									
	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
	WEM									
1. Energy	334 317.08	344 423.02	321 729.78	307 991.99	285 675.98	218 770.25	166 885.60	133 290.94	105 030.45	83 831.83
2. Industrial processes and product use	23 732.01	22 878.65	24 351.84	24 516.29	24 223.83	24 038.87	24 001.47	24 177.30	24 211.94	24 248.02
3. Agriculture	31 659.42	31 659.66	31 705.48	34 051.67	33 334.78	34 650.27	33 810.60	34 519.85	34 285.23	34 379.71
4. Land Use, Land Use Change and Forestry (LULUCF)	-48 018.52	-32 962.30	-29 143.46	-18 957.85	-32 282.75	-24 550.49	-21 107.75	-14 266.51	-14 988.30	-9 651.75
5. Waste	11 000.17	8 275.63	5 608.23	4 752.48	4 652.44	4 268.70	4 041.42	3 786.22	3 568.86	3 372.02
Indirect CO ₂ emissions	564.93	567.87	546.19	582.52	545.78	539.97	531.84	523.60	520.79	518.42
Total (incl. LULUCF)	353 255.10	374 842.53	354 798.06	352 937.10	316 150.06	257 717.57	208 163.19	182 031.40	152 628.97	136 698.24
Total (excl. LULUCF)	401 273.62	407 804.83	383 941.52	371 894.95	348 432.82	282 268.06	229 270.93	196 297.90	167 617.27	146 349.99
Sector	WAM									
	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
	WAM									
1. Energy	334 317.08	344 423.02	321 729.78	307 991.99	284 421.00	202 926.83	151 998.65	105 338.90	80 488.92	66 292.55
2. Industrial processes and product use	23 732.01	22 878.65	24 351.84	24 516.29	24 042.67	23 526.81	22 993.36	22 650.89	22 751.39	22 846.74
3. Agriculture	31 659.42	31 659.66	31 705.48	34 051.67	33 111.96	32 093.93	31 582.27	30 483.55	29 232.54	27 902.20
4. Land Use, Land Use Change and Forestry (LULUCF)	-48 018.52	-32 962.30	-29 143.46	-18 957.85	-45 472.75	-42 083.00	-35 235.54	-29 984.47	-25 952.60	-19 755.99
5. Waste	11 000.17	8 275.63	5 608.23	4 752.48	4 652.44	4 268.70	4 041.42	3 786.22	3 568.86	3 372.02
Indirect CO ₂ emissions	564.93	567.87	546.19	582.52	545.78	539.97	531.84	523.60	520.79	518.42
Total (incl. LULUCF)	353 255.10	374 842.53	354 798.06	352 937.10	301 301.10	221 273.24	175 912.01	132 798.69	110 609.90	101 175.93
Total (excl. LULUCF)	401 273.62	407 804.83	383 941.52	371 894.95	346 773.85	263 356.24	211 147.55	162 783.15	136 562.50	120 931.92

Source: study by KOBIZE, IEP-NRI

National GHG emissions (excluding LULUCF) for all projection years (2025–2050) are higher in the WEM scenario than the emissions calculated for the WAM scenario. The emission reduction in the WAM scenario (with additional measures) relative to the WEM scenario (with existing policies and measures) is the largest for sector 1. Energy. The highest difference between the two scenarios occurs for the years 2040 and 2045 (Fig. 41).

Fig. 41. Historical emissions (1988–2021) and GHG emission projections (including indirect CO₂ emissions and excluding emissions and removals from LULUCF, for the WEM and WAM scenarios

Source: study by KOBIZE, IEP-NRI



The largest differences in emissions between the two scenarios are in sector 1A1a. *Electricity and heat production*. GHG emissions in the WAM scenario are lower than those estimated in the WEM scenario for all years from 2030 onwards, with a difference of more than 10% for 2030 and more than 67% for 2050. The reason for this decline is a further reduction in fuel consumption, especially fossil fuels, mainly coal. The WAM scenario envisages a move away from the use of coal in power generation (lignite from 2040 and hard coal from 2045) and for 2050 the abandonment of natural gas consumption in this sector. It also envisages the use of BECCS to reduce CO₂ emissions from 2044.

For small combustion sources, including households (1A4b), the GHG emission values estimated in the WAM scenario are lower than in the WEM scenario from 2030 onwards. For households, the estimated GHG emission value for 2030 is about 8% lower, and in 2050 this difference is already more than 28%. These differences in GHG emissions result from differences in projected total household fuel consumption in the WEM and WAM scenarios, and due to the very significant reduction in coal consumption in both scenarios, they are driven by differences in the amount of natural gas consumed (in the WAM scenario, consumption of this fuel is lower than in the WEM scenario by 12% in 2030 and as much as ca. 34% in 2050). The reduction in GHG emissions in this sector is also influenced by the lower consumption of hard coal over the period 2030-2045 than in the WEM. The total fuel consumption from 2030 onwards projected for households in the WAM scenario is also lower.

In the transport sector (1A3), emission values under the WEM and WAM scenarios decrease steadily in all projected years relative to the 2020 baseline, with the reduction in emissions being more significant under the WAM scenario, with a difference of 8.6% between the scenarios' GHG emission values in the final year of the projection. This is mainly due to a more decisive shift away from fossil fuels in road transport and a significant reduction in their use in favour of the development of electric drives and the use of hydrogen as an energy source. The larger reduction in GHG emissions is also due to the projected decline in natural gas consumption after 2030.

In the Industrial Processes and Product Use category, the difference between the WAM and WEM scenarios is negligible (less than 1% for all years covered by the projections). This was mainly due to small changes in projected steel and pig iron production. In addition, from 2030 onwards, the WAM scenario includes the use of CCS in reducing CO₂ emissions in the cement industry (of 1 Mg CO₂/year)⁷⁶.

In the agricultural sector, the main difference between the WEM and WAM scenarios is related to a reduction in cattle numbers, from 7 million head to 6.2 million head in 2030 and from 6.8 million head to 5.5 million head in 2050, and a reduction in projected mineral fertiliser use, from 1043 kt N to 800 kt N in 2030 and from 977 kt N to 463 kt N in 2050.

The adoption of different assumptions in the LULUCF sector regarding increment, loss (understood as the sum of net timber volume harvested including bark, logging residues and deadwood) and the difference between increment and loss in each year of the 2024-2030 period allowed independent data to be presented for two alternative projection scenarios (WEM and WAM). In both cases, the projections were based on 11-year forecast cycles. Importantly, both scenarios assume the same pattern of development of timber resources and main use on so-called 'other' forest land (that is, outside State Forests National Forest Holding management). The factor which differentiates the WEM and WAM scenarios is both the level and intensity of cutting and pre-cutting utilisation, expressed in the form of historical utilisation rates for the period 2020-2023. In both scenarios, the level of

⁷⁶ This is linked to a project (<https://www.go4ecoplanet.com/>) underway at the 'Kujawy' cement plant (<https://www.polskicement.pl/aktualnosci/cembureau-roadmap-2020-2050-ograniczenie-emisji-co2-o-ok-40-na-koniec-dekady/>; <https://www.holcim.pl/blog/kujawy>)

utilisation in the State Forests for the years 2020-2023 was assumed based on the actual realisation of the relevant stages in age classes and subclasses.

One of the basic assumptions for the WAM scenario adopted to simulate changes in carbon stocks on State Forests National Forest Holding-managed forest land, enabling the target set for Poland in column C of Annex IIa of the Regulation (EU) 2023/839 to be achieved, is the adoption of a linear reduction in use, for which a reduction to approximately 88% of 2023 use is assumed in 2030 (approx. 49 million m³ of thicket net).

In the WEM scenario, the projection of carbon stock development and use potential in the National Forests for 2024-2030 is based on a simulation reflecting the historical dimension of the level and intensity of forest use (in age classes and subclasses).

For the remaining forest land, no significant changes in forest management practices were assumed that would differentiate the WEM and WAM scenarios. It is worth noting that the level of carbon substitution in wood products was correlated with the projected net timber harvest values. Based on the proportion of timber harvested over the projected period to the 2023 values, the level of potential future production from harvested timber (i.e. sawn timber, wood and wood-based panels, paper and cardboard) between 2023 and 2050 has been determined. It should be noted that both the WEM and WAM scenarios may be subject to some interpretation error. Nonetheless, the aim of this approach is to illustrate possible trends in the production of particular groups of wood raw materials. This area may be subject to significant modifications, taking into account the assessment of the current situation and expected changes in the wood market, expected trends in the development of the wood sector, the assessment of the general economic situation in the country, the impact of the economic situation in foreign markets and the expected future development of the basic macro-indicators characterising the rate of economic development, the development of the construction industry (the creator of direct demand for wood materials and products and secondary demand e.g., for furniture, flooring materials, interior decoration elements), as well as foreign trade.

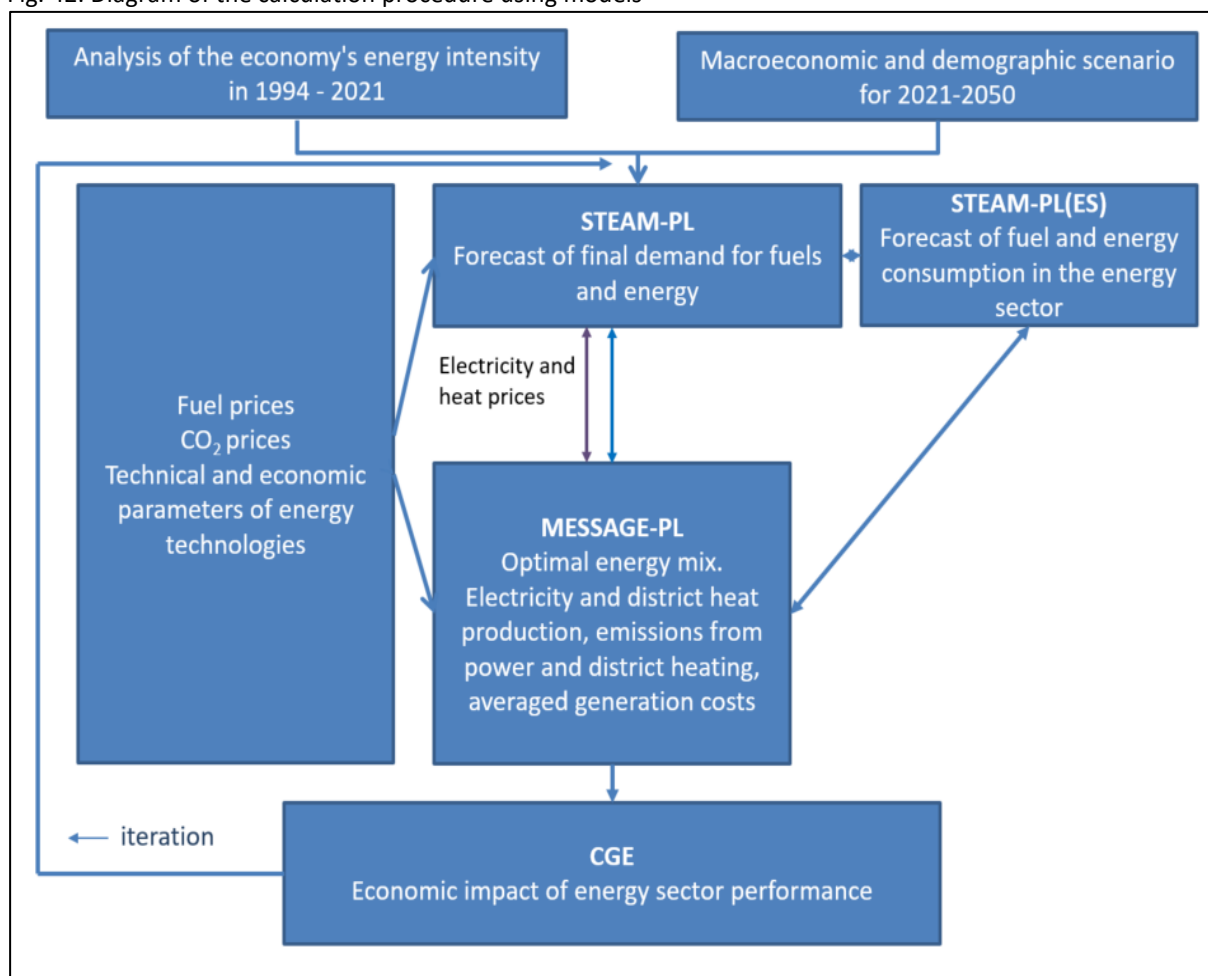
For the waste sector and indirect CO₂ emissions, only the WEM scenario has been developed, with data also used in the WAM scenario.

6.5. Methodology and models used in the development of activity forecasts for the energy sector

The methodology for estimating GHG emissions and removals by sector is consistent with that used in the national inventory reported in 2023. Compared to the projections presented in the Fifth Biennial Report (BR5), there were no significant methodological changes in any category except in the waste sector, where a new data source on waste activities and morphology was used (CSO and Database on products, packaging and waste management instead of Statistics Poland) and the transfer of thermal treatment of municipal waste and sewage sludge to the energy fuel combustion sector.

STEAM-PL and MESSAGE models were used to develop a forecast of domestic energy demand, the results of which were then used to estimate GHG emissions from the energy sector. These are the same models and results that were used in forecasting activity for the energy sector in the Fifth Biennial Report (BR5). A flowchart outlining the forecasting methodology, together with the models used to determine the level of electricity and district heating demand and the optimal way to meet it, is presented on Fig. 42.

Fig. 42. Diagram of the calculation procedure using models



Source: study by ARE S.A.

The starting point in the calculation methodology applied for this report was an analysis of the economy's energy intensity in the period 1994—2021. On this basis, energy consumption was divided into individual sectors and subsectors and further into individual directions of use (heating, lighting, technological processes, etc.) within the subsectors defined in the dedicated model. The existing relationships between individual system elements and the environment were examined, the strength of the linkages, and the extent to which changes in one part of the system affect changes in other areas were determined. Then, based on the assumed projections of the country's economic and demographic development, a coherent scenario was built, which forms the basis for calculating the future level of demand for fuels and energy in the considered time horizon. The first step in the calculation methodology used was to determine the future level of energy demand in the country.

According to the methodology used, the main factors influencing the level of future energy demand were the rate of economic growth described by a series of macroeconomic indexes (GDP and value added in individual sectors of the national economy), demographic processes, projected changes in society's lifestyle, technological progress and energy efficiency improvement processes. Electricity demand projections were made using a bottom-up approach used in the STEAM-PL (Set of Tools for Energy Demand Analysis and Modelling) model⁷⁷. The STEAM-PL model is a tool developed at ARE S.A., adapting the relations and equations it contains to the changing conditions of energy markets,

⁷⁷ Skwierz S. A 'bottom-up' model of energy demand taking into account technological progress and changes in price relations. Agencja Rynku Energii S.A./Warsaw University of Technology, Warsaw 2017.

including the expected technological progress. The projections generated with the use of the aforementioned model are built according to a coherent scenario comprising macroeconomic and demographic assumptions, assumptions regarding the anticipated technological progress and the related rate of improvement of energy use efficiency. Fuel prices in the model are exogenous data. The base year in the model is 2012 – subsequent years are recalibrated to statistical data, while the base year in the analysis is 2020. The STEAM-PL model generates results for fuel and energy demand forecasts, covering all currently used and prospective fuels and energy carriers in all sectors and subsectors of the national economy (including the assumed rate of development of distributed energy). The use of appropriate index allows the total emission of pollutants, corresponding to the consumption of specific fuels in a given sector of the economy, to be estimated in the above-mentioned model. In turn, the STEAM-PL(ES) model determines fuel and energy demand in the energy sector e.g., mines, coking plants, refineries and LNG regasification stations. The results obtained from the STEAM-PL model were compared with those obtained from the MAED and BALANCE models, which were developed and designed at Argonne National Laboratory, Chicago Illinois (USA) and are part of the ENPEP – Energy and Power Evaluation Program, an energy sector analysis package. Their description can be found in many national and international studies. These models have been used by ARE S.A. in forecasting work since the early 1990s.

The projections of demand for electricity and district heating were used as input data for the MESSAGE-PL model (Model for Energy Supply Strategy Alternatives and their General Environmental Impacts), in which the optimal structure of the generation sector and the production from individual generating units required by this demand was determined using the resulting demand volumes. The selection of an economically optimal generation structure (energy mix) in the MESSAGE model is based on the minimisation of the total discounted system costs over the entire time period under consideration, with top-down constraints imposed by climate and energy policy, technical, logistical and raw material conditions. Using the electricity and district heat production volumes calculated in this model for each generation technology, the total sector emissions were computed using appropriate indexes, as well as the averaged costs of electricity generation, which formed the basis for determining retail prices. The CGE general equilibrium model was used to examine the impact of the operation of the fuel and energy sector on the economy.

STEAM-PL model

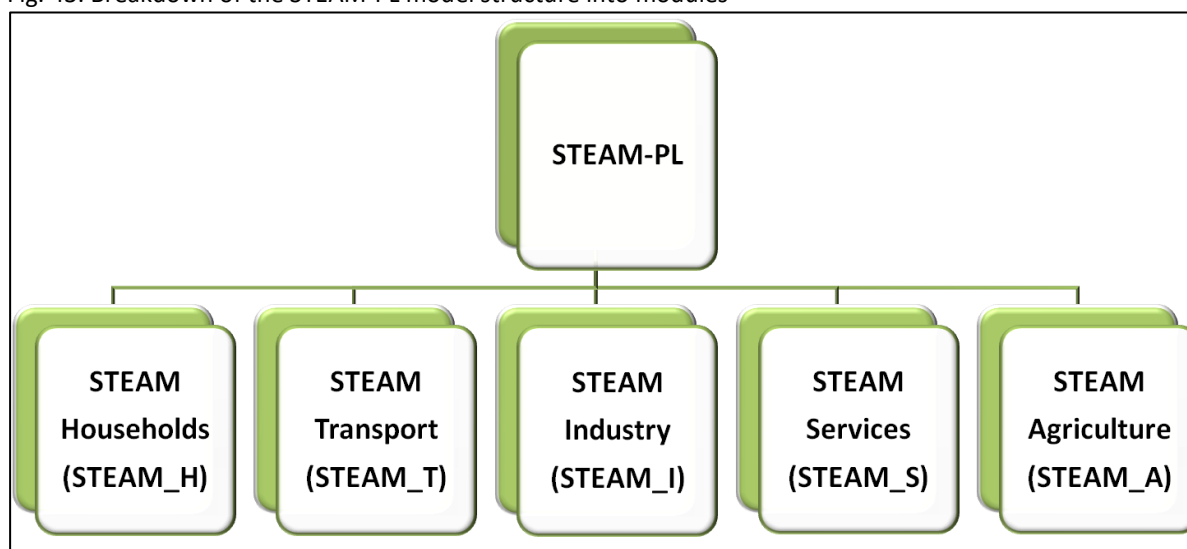
STEAM-PL is an 'end-use' model dedicated to the national fuel and energy system, reflecting in detail the technical aspects related to energy use in the various sectors of the economy. It is an integrated hybrid model enabling the simultaneous determination of the future level of useful energy demand (using the classic 'bottom-up' approach) and the ways of meeting it (using a 'top-down' approach). The model is based on a computational algorithm that simulates the behaviour of energy consumers reacting to changes in the price relationships of fuels and technologies, which enables the analysis of substitution between energy technologies and energy carriers based on the costs associated with the supply of specific energy services (market share algorithm). For this purpose, the model uses econometric modelling of market shares in the form of a logit function (market share algorithm – a mathematical approach used e.g., in the BALANCE/ENPEP⁷⁸ and WEM⁷⁹ models).

⁷⁸ <https://ceesa.es.anl.gov/projects/Enpepwin.html>

⁷⁹ World Energy Model documentation. International Energy Agency, October 2021.
https://iea.blob.core.windows.net/assets/932ea201-0972-4231-8d81-356300e9fc43/WEM_Documentation_WEO2021.pdf

STEAM-PL has a modular structure, meaning that each sector of the national economy defined in it is dedicated to an appropriate module, taking into account in its calculation algorithms a number of distinctive characteristics of the given sector (Fig. 43).

Fig. 43. Breakdown of the STEAM-PL model structure into modules



Source: study by ARE S.A.

The model uses the following division of the national economy's sectors into subsectors, allowing the specific characteristics of the functioning of each economic area to be captured (Table 83).

Table 83. Sectoral structure of the STEAM-PL model

Sector	Subsector
Households	Urban households
	Rural households
Transport	Passenger transport
	Freight transport
Industry	Manufacture of metals and metal foundry operations
	Manufacture of non-ferrous metals
	Manufacture of chemicals and petrochemicals
	Manufacture of non-metallic mineral products
	Manufacture of paper and paper products, printing and reproduction, manufacture of wood products
	Manufacture of food products, beverages and tobacco products
	Manufacture of other industrial products (textiles, wearing apparel, leather and leather products, machinery and equipment, motor vehicles, trailers and semi-trailers, other transport equipment, mining of metal ores, other mining and quarrying, construction, other manufacturing).
Services	Non-commercial services
	Commercial services

Source: study by ARE S.A.

Within each sector and subsector, the following energy use trends have been defined (Table 84).

Table 84. Used by STEAM-PL model division into directions of use

Sector	Subsector
Households	Electrical devices
	Lighting
	Air conditioning and ventilation
	Food preparation
	Space heating
	Household hot water preparation
Transport	Transport work (passenger transport)
	Transport work (freight transport)
Industry	Electric drives
	Lighting
	Space heating and ventilation
	Furnace heat
	Process steam
Services	Space lighting
	Street lighting
	Ventilation
	Air conditioning
	Space heating
	Household hot water preparation
	Electric drives
	Process equipment
	Electrical office equipment
	Refrigeration equipment
	Food preparation
Agriculture	Motor fuels
	Other fuels
	Electricity receivers

Source: study by ARE S.A.

The calculation procedure used in the model can be characterised as follows. The model first determines the level of useful energy demand based on the assumed rate of the country's economic development and factors of a social, technical and regulatory nature.

The drivers⁸⁰ of demand change by sector and use are listed in Table 85.

Table 85. Driving forces behind changes in demand, by sector

Sector	Direction of energy use	Subsector
Households	Electrical devices	Household disposable income
	Lighting	Number of households, floor space
	Air conditioning and ventilation	Households number and disposable income
	Food preparation	Population, number of households
	Space heating	Usable surface area
	Domestic hot water preparation	Population, number of households

⁸⁰ Identified factors that most strongly determine the extent and rate of change in energy demand.

Sector	Direction of energy use	Subsector
Transport	Transport work (passenger transport)	Household disposable income
	Transport work (freight transport)	GDP, value added in industry and construction
Industry	Electric drives	GDP, value added in industry and construction
	Lighting	
	Space heating and ventilation	
	Furnace heat	
	Process steam	
Services	Lighting	Usable surface area of facilities, value added in services
	Space heating	Number of facilities, number of people using the facilities, number of people employed in each activity category and value added in services
	Ventilation	
	Air conditioning	
	Household hot water preparation	
	Electric drives	
	Process equipment	
	Electrical office equipment	
	Refrigeration equipment	
	Meal preparation	
Agriculture	Electricity receivers	Added value in agriculture
	Motor fuels	
	Other fuels	

Source: study by ARE S.A.

In the next step, a set of technologies and installations/devices is identified to cover the demand for individual energy services. The following have been used to determine the baseline: the results of the cyclical (every three years) survey of fuel and energy consumption in households⁸¹, the results of the statistical survey 'Fuel and energy balances'⁸², as well as the results of analyses carried out by recognised research centres and industry institutions. Using the projected number of appliances, their technical and economic characteristics and the projected intensity of use, the final energy consumption has been calculated. Improvements in the energy efficiency of electrical appliances are taken into account through assumptions related to technological developments (energy efficiency classes). The rate at which existing appliances are replaced by new ones with higher energy efficiency classes is assumed by analysing historical trends, as a result of the prediction obtained in the relevant econometric models and on the basis of sales data obtained from manufacturers, for each individual appliance (the rate at which old appliances are replaced by new ones may also be determined by the user). The division into energy classes is applied to all electrical appliances defined in the model (e.g., in the module dedicated to households, 72 different types of electrical appliances for everyday use and 6 types of air-conditioning and ventilation appliances have been defined). The aforementioned market share algorithm is applied to determine the directions of energy use such as heating and hot water preparation and how energy needs are covered.

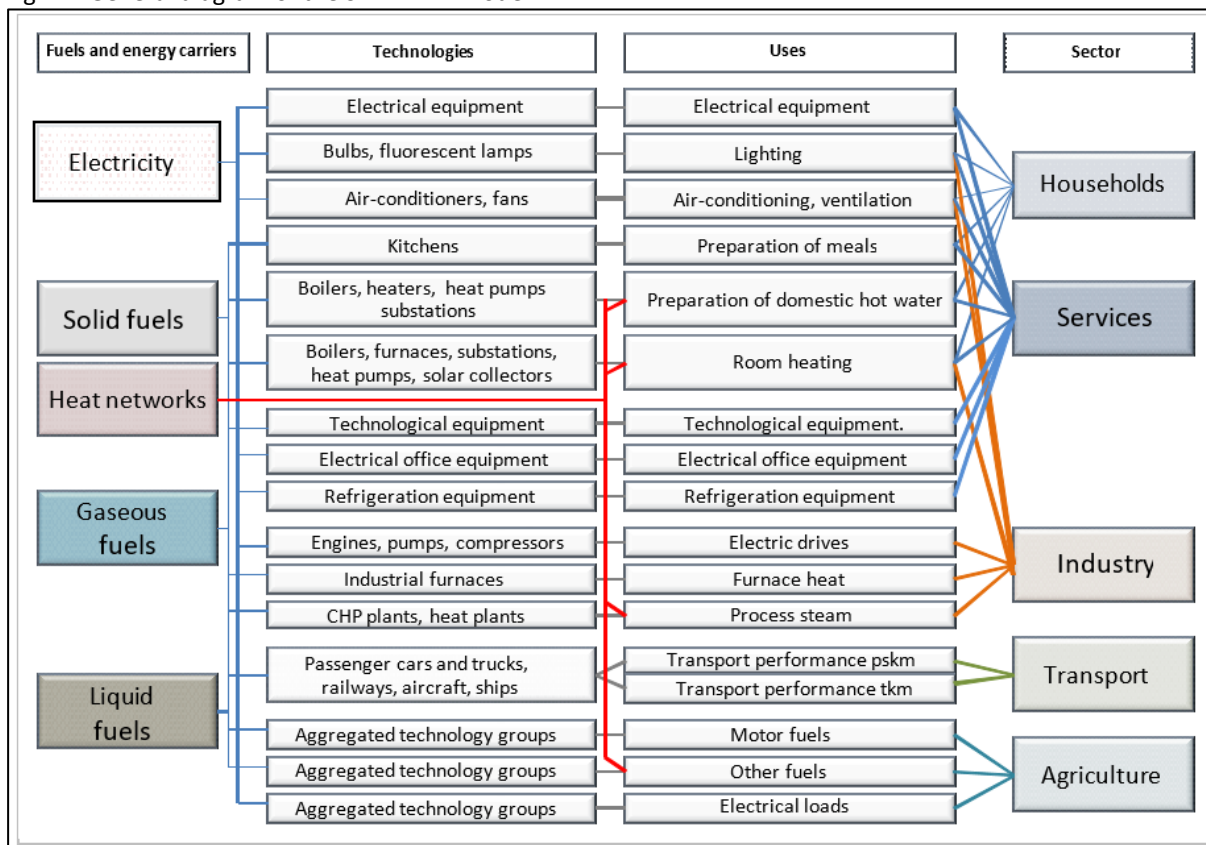
For the manufacturing sector, the model uses a slightly different approach than for services and households. First, projections of the production of energy-intensive industrial products are prepared (as exogenous data resulting from the economic strategy and from dedicated economic models), and then, based on historical data, energy intensity indexes are determined for the given product groups.

⁸¹ 'Consumption of energy by households' – Statistics Poland, Warsaw, 2002, 2009, 2012, 2015.

⁸² G-02b (Balance report of energy carriers and heating infrastructure), G-03 (Report on fuel and energy consumption).

These indexes are extrapolated, which is an element reflecting the course of energy efficiency improvement processes (the values of the aforementioned indexes can be freely shaped by the user, who relies on historical data, as well as on data concerning the possibilities of technological development in the future). The resulting level of energy demand is then subdivided into individual directions of use, within which, by means of a market share algorithm, ways of meeting that demand are simulated by individual groups of dedicated technologies described by a number of technical and economic parameters – under given technical, raw material and environmental constraints. Fig. 44 shows a schematic of the model, and the individual elements defined in the STEAM-PL.

Fig. 44. General diagram of the STEAM-PL model



Source: study by ARE S.A.

MESSAGE-PL model

The model of alternative energy supply strategies and their overall environmental impact (MESSAGE) was designed as an optimisation model for medium and long-term energy system planning, development scenarios and energy policy analysis. The MESSAGE model⁸³ was created and is still under development at the Institute for Applied Systems Analysis in Laxenburg (IIASA, Austria). The International Atomic Energy Agency (IAEA) took over the MESSAGE model in 2000, and it is continuously updated and improved by to support detailed analyses of alternative energy strategies, including the use of nuclear technologies. A special agreement between the IIASA and the IAEA allows its use in countries that have signed relevant agreements – Poland is one of such countries. At ARE S.A., the MESSAGE model has been adapted to Polish conditions.

The methodology used in the MESSAGE model is based on the optimisation of an objective function under given resource constraints, fuel and trade availability, new investments, market saturation of

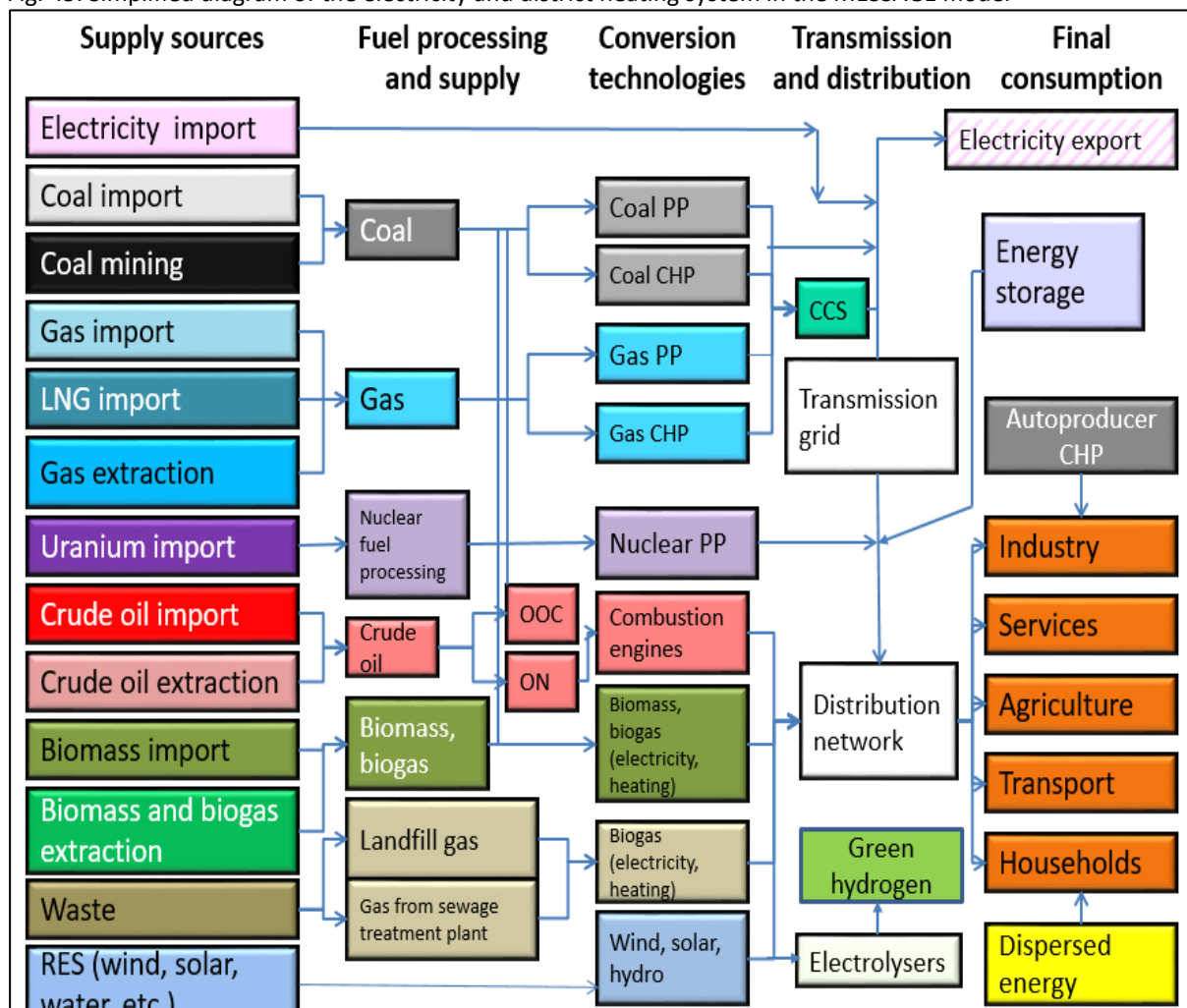
⁸³ MESSAGE – Model for Energy Supply Strategy Alternatives and General Environmental Impacts, User Manual, IAEA, 2007.

new technologies, emission standards and waste generation, to formulate and evaluate alternative energy supply strategies for a given amount of energy demand.

The objective function is defined as the minimisation of the summed discounted system costs over the entire time interval considered and entire supply chain, using linear or integer programming methods, for certain tasks (e.g., selection of generators with specified power – large coal and nuclear units).

MESSAGE operates on a user-defined network of energy flows, from extraction or supply of primary energy, through transformation (e.g., electricity and heat generation), transmission and distribution, to end users (Fig. 45).

Fig. 45. Simplified diagram of the electricity and district heating system in the MESSAGE model



Source: study by ARE S.A.

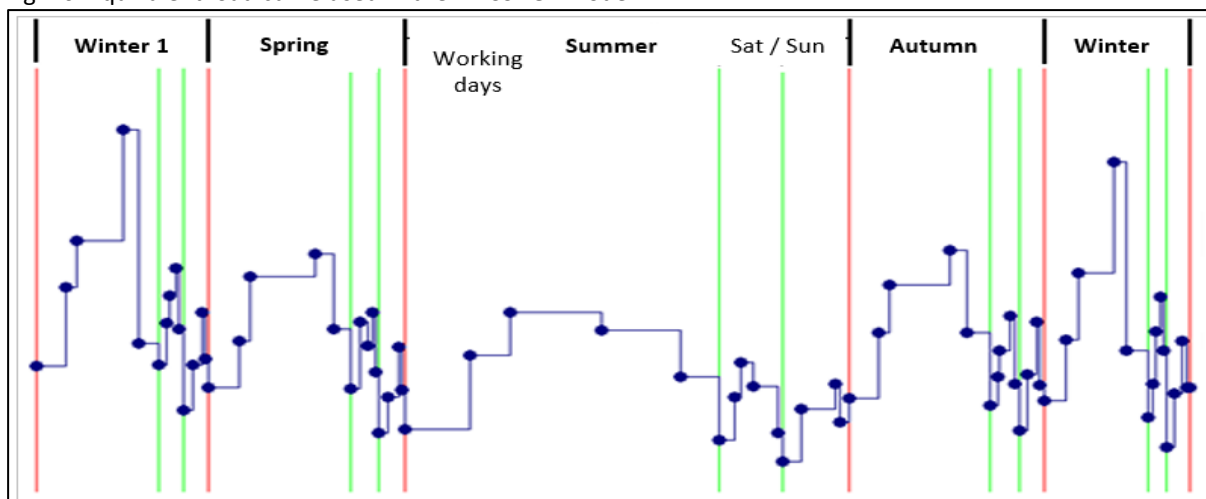
Both existing technologies and new generation units are part of the grid. Currently, the model includes about 100 existing generation units and new types of technologies (e.g., high-efficiency coal- and gas-fired technologies without and with CO₂ capture, renewable technologies – RES, nuclear power plants, cogeneration technologies, energy storage, electrolyzers, DSR services). The model takes into account long-term air pollutant and CO₂ emission targets (including EU ETS emission permit restrictions) and state policy instruments to promote RES and cogeneration.

An important advantage of the MESSAGE model is the ability to differentiate the level of demand for a given energy carrier by season, type of day and time of day. This information is the basis for determining the technological mix and the mode of operation of the installed units (base, sub-peak

and peak load operation). The equivalent load curve in the NPS used in the MESSAGE model (Fig. 46) is created using data from PSE S.A. concerning the load level for historical periods and forecasts of changes in the curve prepared by ARE S.A.

Based on the optimal structure of the generation sector determined using the MESSAGE model and the required production demand from individual generating units, the unit averaged costs of electricity generation in Poland over the considered time horizon are determined.

Fig. 46. Equivalent load curve used in the MESSAGE model



Source: study by ARE S.A.

CGE model

A recursive-dynamic CGE (Computable General Equilibrium) model has been used for the analysis. The model assumes that markets are moving towards equilibrium. Following the introduction of an impulse (shock) considered in the scenarios, the model allows a new equilibrium to be determined in product and factor markets, shaped by adjustments to prices, wages and returns on capital. Producers adjust the structure of inputs – including capital and raw materials – to changing market prices, within the technological options available. Similarly, consumer demand changes under the influence of changing prices and incomes. The CGE model also considers key relationships with the external environment through changes in imports and exports of goods and services.

In the analysis, the results provided by the MAED and MESSAGE models served as an input to the CGE model. Combining the models improves the consistency of the projections and provides a completed and more detailed picture of efforts to assess the impacts of climate and energy policies. In particular, the use of the aforementioned models allowed for a more detailed capture of technology change in key areas of the economy and the associated fuel consumption and capital expenditure volumes associated with the use of these technologies.

The macroeconomic analysis and assessment was carried out in two scenarios – WEM and WAM for the years 2020–2050 in 5-year steps. The assessment presented here concerns the analysis of variables that play a key role in the assessment of economic impacts namely changes in GDP, household consumption, investment and import and export balances.

The assessment has been conducted by analysing and comparing the WEM and WAM scenarios. In the CGE model, the change in GDP is adjusted first to the WEM scenario and then, based on external projections from the MAED and MESSAGE models, fuel consumption in economic sectors and fuel and energy prices are adjusted in response to external projections from the MAED and MESSAGE models.

For the WAM scenario, fuel consumption, fuel and energy prices are adjusted based on external projections and the need for additional investment is taken into account. Other variables, such as capital stock, labour stock and their productivity across industries, remain constant between scenarios. In addition, global fuel price paths and European GHG emission prices do not change in the two scenarios analysed.

7. Other information

Pursuant to para. 103 of the Annex to Decision 18/CMA.1 *'Each Party may provide any other information relevant to tracking progress made in implementing and achieving its NDC under Article 4 of the Paris Agreement'*. All relevant information on NDCs can be found in Chapters III.1. to III.6. of this Report. Therefore, no additional information needs to be presented in Chapter III.7.

IV. Information related to climate change impacts and adaptation under Article 7 of the Paris Agreement

1. National circumstances, institutional arrangements and legal frameworks

The main features of national circumstances and institutional arrangements for climate change are described in detail in *Chapter III.1 National circumstances and institutional arrangements* of this document. Selected issues relevant to climate change adaptation are presented below.

1.1. National circumstances

1.1.1. Demographic situation

Demographic situation in Poland is changing in terms of the number and structure of the population. The process of depopulation, aggravated by low fertility rates and population ageing resulting e.g., from longer life expectancy, is characteristic. The number of population in the post-working age in 2000—2023 increased by more than 3 million to 8.8 million, and the percentage of this group increased in that period from less than 15% to over 23%. The process of ageing of Poland's population will continue in the next decades, which means an increase in the percentage of people aged 65 and over in 2060 by nearly 37% compared to 2022 and a large decrease in the number of children and young people (0—17 years) – by 30%, and the number of people in working age – by 32%⁸⁴. At the same time, a large increase in the number of people aged 85 and over is projected (almost one and a half times).

Another phenomenon observed in Poland is urban shrinkage. The urban population accounts for more than 59% of the total population and the number of urban residents is shrinking (in 2023, the annual urban decrease rate was -0.5%, while in rural areas it reached -0.1%). The decline in the urban population is linked not only to demographic changes (low fertility rates and emigration), but also to suburbanisation.

In the 2030 perspective, strong development is expected in the main urban agglomerations and areas in their immediate vicinity, which will continue to attract people from peripheral regions, while the population in most major urban centres will decline⁸⁵. Of the 37 cities with a population of over 100 000, only six will experience population growth (Rzeszów, Warszawa, Gdańsk, Kraków, Wrocław and Zielona Góra). A further significant influx of population into the suburban areas around the main urban centres is projected, which will result in the expansion of the areas of the individual agglomerations and a significant increase in population in the municipalities neighbouring the large cities.

⁸⁴ Population projection 2023—2060. Statistics Poland 2023.

⁸⁵ Population projection for gminas 2023—2040. Statistics Poland 2023.

1.1.2. Economic and infrastructure characteristics

The greatest impacts of climate change arise from the increased frequency of extreme climate events, which have a significant influence on vulnerable areas, the country's infrastructure and the economy. Extreme events related to climate change cause particularly negative impacts in those economic sectors that depend directly on climate conditions.

Extreme phenomena cause significant losses in Poland every year. In the decade 2001-2010, the catastrophic effects of floods were the biggest problem, while currently losses caused by water shortages are becoming particularly acute⁸⁶. Before 2010, damage to infrastructure due to floods was the most common, whereas currently the costs of extreme phenomena are felt most by agriculture, which suffers measurable losses due to unfavourable weather conditions e.g., spring frost, hurricanes, flooding and flash floods, adverse effects of overwintering, drought, etc. In addition, the high fragmentation of the agricultural sector means that owners of relatively small farms are unable to implement effective measures to safeguard agricultural production against the effects of change. The available solutions are too costly for small farms and therefore not profitable, moreover, the effectiveness of such investments is also a challenge. A further deficit of water resources in many agricultural regions, such as those located in the Central Polish Lowlands and lake districts, the Sudetes Foreland, the Małopolska Uplands, the Lublin Uplands and the Podlasie Lowlands, will be of great importance for the future security of the country's food supply. The effects of climate change in agriculture have consequences for related industries, namely processing or trade. The problem of financial losses also affects urbanised areas, where damage to municipal infrastructure (buildings, roads) occurs as a result of heavy rainfall. Water management is another sector with a high percentage of losses due to extreme events.

The impact of climate change hazards on a country's economic situation is very complex: *'It includes not only the impact of the physical characteristics of an extreme event or its immediate aftermath, but also the macroeconomic resilience of the economy to disasters. It depends on the ability to limit the size of the immediate loss of income for a given amount of disaster losses. Factors supporting the macroeconomic resilience of the economy to the impact of the phenomena include low interest rates to stimulate investment development, an efficient and short recovery process, and ensuring continuity of economic activity, at each stage of the supply chain, including in the linkages between production sectors in the economy'*⁸⁷. The following have been identified as the most important sectors of the national economy where adaptation measures are needed to maintain their sustainability: agriculture and rural areas, forestry, energy, construction, including building infrastructure and building operations and housing, water management, maritime economy and coastal protection, transport, services, including health, biodiversity conservation and tourism⁸⁸.

⁸⁶ Siwiec, E. (Ed.) 2022. Atlas of the Effects of Extremal Phenomena in Poland; IEP-NRI; <https://klimada2.ios.gov.pl/files/2023/>.

⁸⁷ Ibidem.

⁸⁸ PWC. Recommendations for updating the Strategic Plan for Climate Change Adaptation to 2040 and developing an action plan and roadmap to 2050 (draft).

1.2. Institutional arrangements and governance

The Ministry of Climate and Environment is the key actor responsible for climate change adaptation at the national level. One of its primary tasks in this area remains the setting of targets and the initiation, development and implementation of climate change adaptation policies. The Ministry of Climate and Environment is also responsible for monitoring and evaluating the implementation of the national adaptation policy. In close cooperation with other ministries, the Ministry of Climate and Environment coordinates and monitors the implementation of strategic projects in this area carried out by other ministries. The wide range of tasks of the government administration related to ensuring security in the risk of extreme climate events and supporting adaptation to ongoing climate change has been defined in terms of areas and issues arising from their assigned competences.

Table 86. Institutions implementing and supporting climate change adaptation policies

Institutions	Key tasks concerning adaptation
Ministry of Climate and Environment	• initiating, developing and implementing climate change adaptation policies; • establishing adaptation policy objectives and priorities; • coordinating and monitoring the implementation of strategic projects also implemented by other ministries.
Ministry of Agriculture and Rural Development	• ensuring optimal conditions for the sustainable development of the Polish countryside, agriculture and fisheries, and ensuring food safety and high-quality public services.
Ministry of Infrastructure	• ensuring sustainable development and the efficient functioning of the economy and society under conditions of a changing climate and the risks caused by these changes. Seeking, on the one hand, to increase the well-being of the society, the economy and the environment by ensuring optimal conditions for their functioning and, on the other hand, reducing exposure, disruption and losses caused by extreme weather and natural disasters.
Ministry of Development Funds and Regional Policy	Programming and coordinating development policy, in particular: • preparing a national development concept, a medium-term development strategy; • programming and implementing regional policy, including urban policy, and coordinating programmes and activities concerning revitalisation of socially and economically degraded areas; • drafting programming documents in the field of socio-economic, regional and spatial development of the country and developing plans, including those being the basis for obtaining development funds from the European Union and other foreign sources. Management of the European Funds system, including preparing and monitoring the implementation of the strategy for the use of funds through the Partnership Agreement.
Ministry of Interior and Administration	• coordinating support for those affected by extreme events (floods, flooding, storms and other phenomena), including local government units.
Government Centre for Security	Implementing tasks for disaster risk reduction: • monitoring and reporting on the implementation of the 'Sendai Framework for Disaster Risk Reduction 2015-2030', including the 'Disaster Risk Reduction Strategy'; • organising and coordinating the work of the National Platform for Disaster Risk Reduction; • organising the National Forum for Disaster Risk Reduction. It serves as the national contact point for the implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030.
Ministry of Culture and National Heritage	• protecting cultural heritage in the event of specific threats, including climate hazards.
Ministry of Science and Higher Education	Conducting state policy in the area of science and being responsible for: • preparing strategic solutions for science; • coordinating programmes and the use of EU funds for science, including within the framework of the Horizon programme, including the 'Climate Change Adaptation' and 'Climate Neutral and Smart Cities' missions; • developing programming documents and programmes at national and European level; • supporting the participation of Polish scientists in scientific research abroad; • overseeing the National Science Centre and the National Centre for Research and Development.

Institutions	Key tasks concerning adaptation
Ministry of National Education	• updating the content of the core curriculum for pre-primary education and general education in particular types of schools with regard to teaching in the area of climate change and sustainable environment education.
Minister for Senior Citizens' Policy	• coordinating activities of government bodies in monitoring the situation of older people; • initiating, supporting and promoting senior policy solutions; • drafting proposals for the development of senior policy.
Minister for Civil Society	• strengthening civil society also in the dimension of combating climate change.
General Directorate for Environmental Protection	Undertaking biodiversity conservation activities, namely: • drafting a national strategy for the conservation and sustainable use of biodiversity and the action programme; • developing programmes for conservation of endangered plant, animal and fungal species.
National Fund for Environmental Protection and Water Management (NFEP&WM)	Supporting environmental measures, including adaptation in the context of action funding.
State Water Holding 'Polish Waters'	Supporting implementation of water management policies: • preparing preliminary flood risk assessment, flood risk maps and flood hazard maps, flood risk management plans, drought management plan.
Maritime Administrations	• implementing a maritime policy for adaptation to climate change.
Statistics Poland	• collecting, assembling, storing and compiling statistical data for e.g., environmental surveys (https://stat.gov.pl/) https://stat.gov.pl/
Institute of Meteorology and Water Management – National Research Institute (IMGW-PIB)	Monitoring of the state of the atmosphere and hydrosphere. Collecting and sharing data on climate change: • historical meteorological and hydrological measurement data (https://danepubliczne.imgw.pl/); • climate maps (https://klimat.imgw.pl/pl/climate-maps/); • forecasts for the Baltic Sea (https://baltyk.imgw.pl/); • flood threats and risks, jointly with the State Water Holding 'Polish Waters' (https://www.powodz.gov.pl/pl/o_mapach).
Institute of Environmental Protection – National Research Institute (IEP-NRI)	Conducting research on climate change. Providing data and analysis results (https://klimada2.ios.gov.pl/): • climate scenarios; • climate risk assessment; • estimating costs and damages coming from extreme events; • good adaptation practices; • publications on climate change; • educational materials.
Institute for Ecology of Industrial Areas	Conducting research and projects on: • sustainable management of environmental resources, including on industrialised sites; • building adaptive capacity through rehabilitation of brownfield sites (development of blue-green infrastructure).
Institute of Soil Science and Plant Cultivation – National Research Institute	Conducting research and monitoring on: • assessing the impact of climate change on agriculture and methods of adaptation for agriculture: http://www.iung.pl/; • agricultural drought risk – Agricultural Drought Monitoring System (ADMS): https://susza.iung.pulawy.pl/.
Institute of Hydro-Engineering of Polish Academy of Sciences	Hydrodynamic monitoring for coastal protection on the Hel Peninsula: https://polskibrzeg.ibwpan.gda.pl/
Polish Geological Institute – National Research Institute	Conducting monitoring and research in the field of: • monitoring of groundwater; • assessing the state and prognosis of the hydrogeological situation in groundwater recharge and abstraction zones, hydrological warnings; • assessing landslide susceptibility, landslide hazards and risks, landslide hazard warnings.

Source: study by the IEP-NRI

Cross-sectoral cooperation takes place through joint projects, working groups, informal cooperation, various forums for the exchange of opinions and information, including conferences, meetings. An example of such activities is the organisation and coordination by the Government Centre for Security of the work of the National Platform for Disaster Risk Reduction, which involves not only representatives of government and local administration, but also scientific and research institutes, NGOs and the private sector. The platform, which currently has more than 100 members, is working with the Government Centre for Security to implement the Sendai Framework for Disaster Risk Reduction 2015-2030 programme.

Another important action in managing the adaptation process is the establishment of the Executive Council for the National Urban Policy 2030, responsible for coordinating the implementation of the solutions contained in the document and monitoring the implementation process. A new structure is the Inter-Ministerial Team for systemic solutions related to the care of the elderly. Measures undertaken as part of the work of this Team will promote increased adaptability to climate change of a social group particularly vulnerable to the effects of climate change, including extreme weather events.

The scientific community supports adaptation policy at the stage of diagnosing current and future climate risks and formulating adaptation policy and popularising adaptation solutions. One of its tasks is to collect, compile and share the data and information necessary to manage the adaptation process with government and local administrations, as well as with other entities and individuals. Research on adaptation is conducted e.g., by the Institute of Meteorology and Water Management – National Research Institute, the Institute of Environmental Protection – National Research Institute, the Institute for Ecology of Industrial Areas – National Research Institute, the Institute of Soil Science and Plant Cultivation – National Research Institute. The list of scientific institutions involved in researching climate change issues and popularising the results is much longer.

1.3. Legal and policy framework and regulations

The first and the most important strategic document that directly addresses the issue of adaptation to ongoing climate change is the national 'Climate Change Adaptation Strategy to 2020 with an Outlook to 2030'. Adaptation is also one of the objectives of basic national strategic documents, such as the medium-term development strategy and other development strategies relating to sectors, fields, areas or spatial development. The issue of adaptation to climate change has been included in the 2030 National Environmental Policy 2030, Strategy for Sustainable Rural, Agricultural and Fisheries Development 2030, Energy Policy of Poland until 2040, Sustainable Transport Development Strategy until 2030 (more in Chapter IV.4.). An additional strategic document supporting the adaptation of urbanised areas to climate change is the National Urban Policy 2030. Adaptation planning in the field of water management is included in the documents: Drought Management Plan, River Basin Management Plans and Flood Risk Management Plans prepared in planning cycles by the State Water Holding 'Polish Waters'.

National policies (Strategy for Sustainable Rural, Agricultural and Fisheries Development 2030 and 2030 National Environmental Policy) identify strategic projects that include various smaller projects and initiatives to support climate change adaptation. These programmes are implemented both by the Ministry of Climate and Environment and other public institutions, including that subordinate to the Ministry, as well as by external entities selected through joint procurements, including commercial

ones. They are subject to quarterly monitoring and reporting by the Prime Minister's Office and the Ministry of Climate and Environment.

At the local level, adaptation is also implemented through municipal climate change adaptation plans, which mostly apply to large and medium-sized cities that have adopted such adaptation plans in the form of city council resolutions. The plans have the status of municipal strategic documents and are evaluated and updated. The Ministry of Climate and Environment supports cities in their implementation, including through appropriate programming of the EU financial perspective 2021—2027. In the future, the obligation to prepare adaptation plans will also apply to smaller cities (with a population of 20,000 or more).

In the situation of extreme climate events (floods, waterlogging, storms and other phenomena), support for those affected is provided under the provisions of the Act on Public Finance, the Act on Social Welfare, the Act on Local Government Unit Revenues and, in a subsidiary manner, under the rules for providing financial assistance from the state budget, and the guidelines of the Minister of Internal Affairs and Administration^{89 90}. Aid for dealing with the consequences of natural disasters is provided to local government units from targeted subsidies from the state budget. A detailed description of the legal and policy framework for adapting to a changing climate and minimising the effects of climate change is provided in Chapters IV.4. and IV.7.

Among the legal solutions supporting adaptation to climate change is the system of environmental impact assessments, both at the level of strategies, plans and programmes (strategic environmental assessment, SEA) and projects (environmental impact assessment, EIA). According to the law, climate risk is always taken into account in environmental impact assessments. The Ministry of Climate and Environment and scientific institutions support the integration of climate change adaptation into decision-making processes by publishing handbooks and manuals⁹¹.

⁸⁹ Guidelines of the Minister of the Interior and Administration on the principles and mode of granting to local government units targeted subsidies from the state budget for co-financing their own tasks related to renovation, reconstruction and restoration of buildings destroyed or damaged as a result of events bearing the signs of a natural disaster, dated 13 April 2021.

⁹⁰ Guidelines of the Minister of the Interior and Administration on the principles and mode of granting to local government units targeted subsidies from the state budget for co-financing their own tasks involving the repair, reconstruction, construction, relocation, stabilisation and improvement of public infrastructure destroyed, damaged or endangered by landslide movements or coastal erosion, dated 13 April 2021.

⁹¹ Ministry of Climate and Environment 2023. 'Guidebook for verifying investments in terms of climate impact and climate change adaptation in the EU programming period 2021—2027' and Hajto M., Cichocki Z., Kuśmierz A., Borzyszkowski J. 2021. Climate change and climate change adaptation in environmental impact assessments. Handbook. IEP-NRI. <https://klimada2.ios.gov.pl/pokaz-publikacje/>

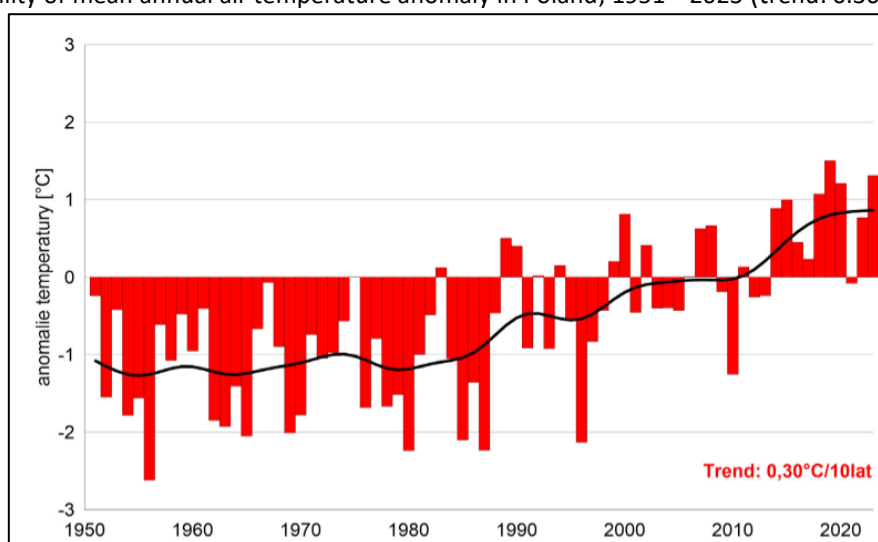
2. Impacts, risks and vulnerability to climate change

2.1. Current and projected climate change and associated risks

2.1.1. Current climate change in Poland

The apparent warming throughout Poland has accelerated in recent years. Air temperature is increasing from decade to decade. Since the middle of the 20th century, the average annual air temperature has increased by 0.30°C in 10 years on average, reaching a value that is more than 2.0°C higher than at the beginning of the period (Fig. 47). The rate of temperature change varies between climatic regions. In the lake district belt and the lowlands, Sub-Carpathians and Carpathians, air temperature has increased by 2.1°C over the last 70 years. The slowest increase in air temperature has been observed in the Sudetes (1.8°C). Changes in air temperature are seasonally differentiated. Since the beginning of the second half of the 20th century, winter temperatures have increased by 2.5°C and summer temperatures by 1.9°C .

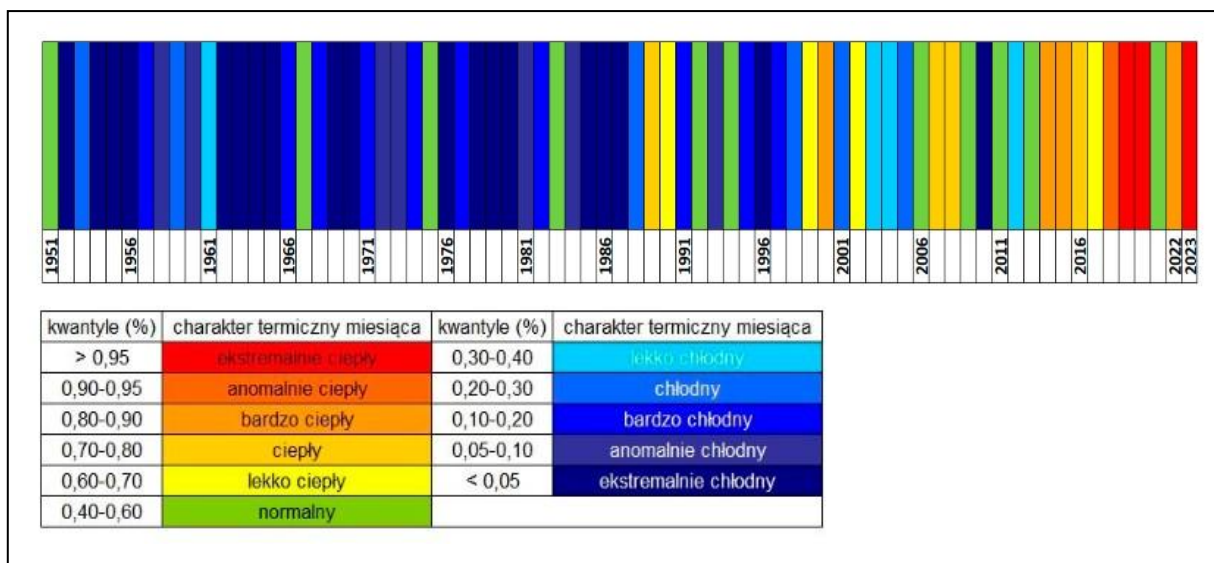
Fig. 47. Variability of mean annual air temperature anomaly in Poland, 1951—2023 (trend: $0.30^{\circ}\text{C}/10$ years)



Source: *Climate of Poland 2023*, IMGW-PIB, 2024

The last 22 years have been the warmest since the mid-20th century. The record warmest year was 2019 with an average air temperature of 10.2°C . A characteristic feature of Poland's climate is the high interannual variability of air temperature, which is manifested in the occurrence of years that are markedly cooler than average, although this happens much less frequently than before 1991 (Fig. 48). Descriptive classifications are used to illustrate the thermal conditions, indicating to what extent the thermal conditions differed from typical ones. The classification is based on the empirical distribution of the mean temperature values for each month, season or year over the normal period 1991–2020, allowing the threshold values of the respective classes to be determined using a specified probability. The different classes are given descriptive names. The last decade represents a period of conditions ranging from very warm to extremely warm.

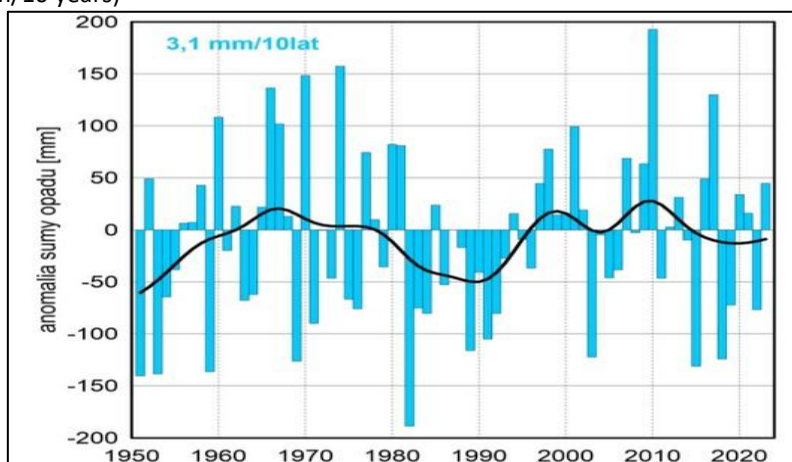
Fig. 48. Multiannual variability of thermal conditions in Poland



Source: *Climate of Poland 2023*, IMGW-PIB, 2024

The amount of precipitation in Poland is characterised by strong inter-annual and seasonal variability. Changes in the amount of annual precipitation amounts to 21.7 mm since the mid-20th century (Fig. 49).

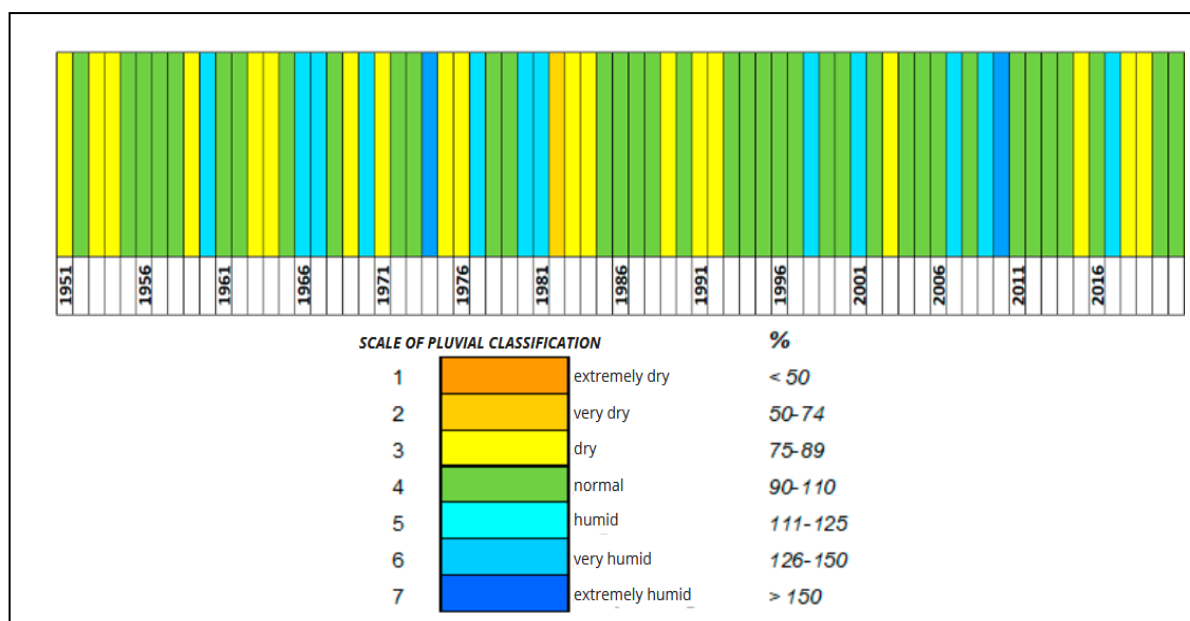
Fig. 49. Area-averaged precipitation anomalies in Poland compared to the reference period 1991-2020; trend value (mm/10 years)



Source: www.imgw.pl/wydarzenia/charakterystyka-wybranych-elementow-klimatu-w-polsce-w-2023-roku-podsumowanie

The strong fluctuations in precipitation during the last decade, described according to Kaczorowska's classification of pluvial conditions, which is based on the percentage deviation of precipitation in a given year from the precipitation norm for a given location, is characterised by the occurrence of consecutive dry and wet periods (Fig. 50). Few years are classified as normal years in terms of pluvial conditions.

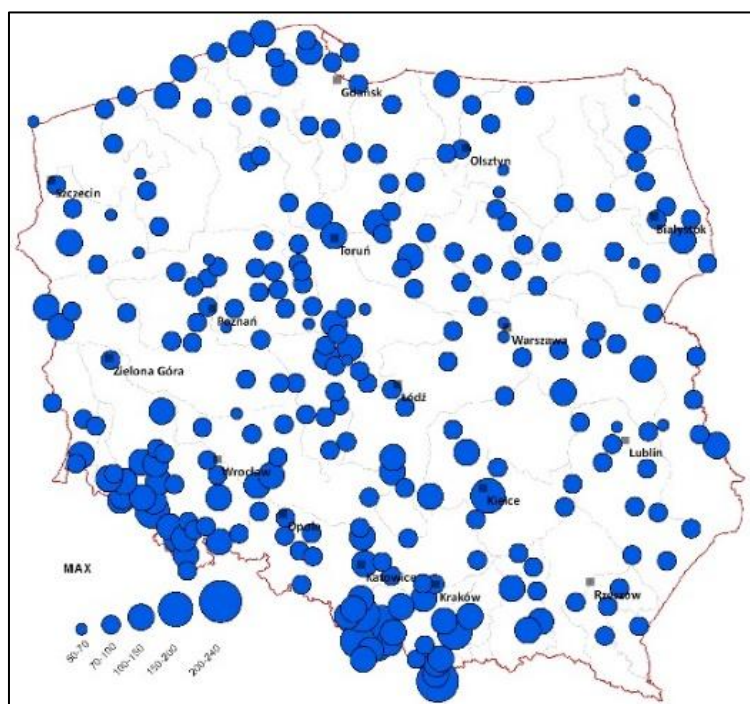
Fig. 50. Variability of pluvial conditions in Poland since 1951



Source: *Climate of Poland 2023*, IMGW-PIB, 2024

The high variability of precipitation is also evidenced by the high daily totals. Extremely high daily precipitation, above 150, 200 mm, occurs most frequently in mountainous areas e.g., in the Tatras or the Sudetes. Extremely high precipitation, with daily totals exceeding 100 mm, can occur throughout the country. Extreme high precipitation may exceed all previously recorded values in a given area by several times (Fig. 51)⁹². There has been a change in the structure of precipitation over the most part of Poland with a sharp increase in the number of days with extreme precipitation.

Fig. 51. Maximum daily precipitation at selected stations of the IMGW-PIB in the years 1951-2010



Source: <https://imgw.isok.gov.pl>

⁹² <https://imgw.isok.gov.pl>

2.1.2. Projected climate change

Method for developing climate change scenarios for Poland

One of the more comprehensive scenarios of climate change in Poland until 2100 has been prepared by the Institute of Environmental Protection – National Research Institute as part of a project co-financed by the Operational Programme Infrastructure and Environment. Future climate conditions in Poland were developed based on climate simulations for the period 2006-2100 made available within the EuroCORDEX project. Simulations of regional climate models for Europe were used, on a regular grid with a resolution of 0.11° (approx. 12.5 km).

Analyses of temperature and precipitation changes were carried out for the two most commonly considered development scenarios: RCP4.5 and RCP8.5. The moderate RCP4.5 scenario assumes a further increase in atmospheric carbon dioxide concentration – to 540 ppm in 2100 – and to reach a radiative forcing of 4.5 W/m^2 , while the extrapolation scenario RCP8.5 corresponds to an increase in CO_2 concentration to 940 ppm and radiative forcing to 8.5 W/m^2 in 2100.

All available simulations for the parameters: daily mean temperature, daily maximum temperature, daily minimum temperature, daily precipitation sum were downloaded from the EuroCORDEX repository⁹³. A single unique result is clearly defined by the global climate model (GCM), the results of which were used as boundary conditions for simulations, and the regional climate model (RCM) which was used as a computational tool for dynamic downscaling. To calculate climate change projections for Poland, statistical scaling was additionally applied based on historical data using observations from the reference period 2006-2018 and a bundle approach to assess projection uncertainty. For the application of statistical scaling techniques, the following spatially agreed to regular grid temperature and precipitation fields, derived from ground observations or reanalyses, were used⁹⁴:

- data from the Institute of Meteorology and Water Management – National Research Institute;
- E-OBS11 – daily resolution data covering the total precipitation field and the minimum, mean and maximum temperature fields in Europe based on information from the ECA&D (European Climate Assessment & Dataset) repository;
- Reanalysis ERA512 – created according to the 4DVar data assimilation method from CY41R2 of the Integrated Forecast System (IFS) by the European Centre for Medium-Range Weather Forecasts (ECMWF);
- UERRA (Uncertainties in Ensembles of Regional ReAnalyses) – an experimental regional reanalysis for Europe using a bundle approach.

Based on the four basic meteorological parameters (mean temperature, minimum temperature, maximum temperature and precipitation amount), a set of climate indicators has been calculated to assess exposure to climate phenomena. Changes in future climate conditions are presented as a trend described by a 10-year moving average and differences for the selected indicators between the decade 2051–2060 and 2011–2020.

Projected changes in temperature and precipitation by 2100

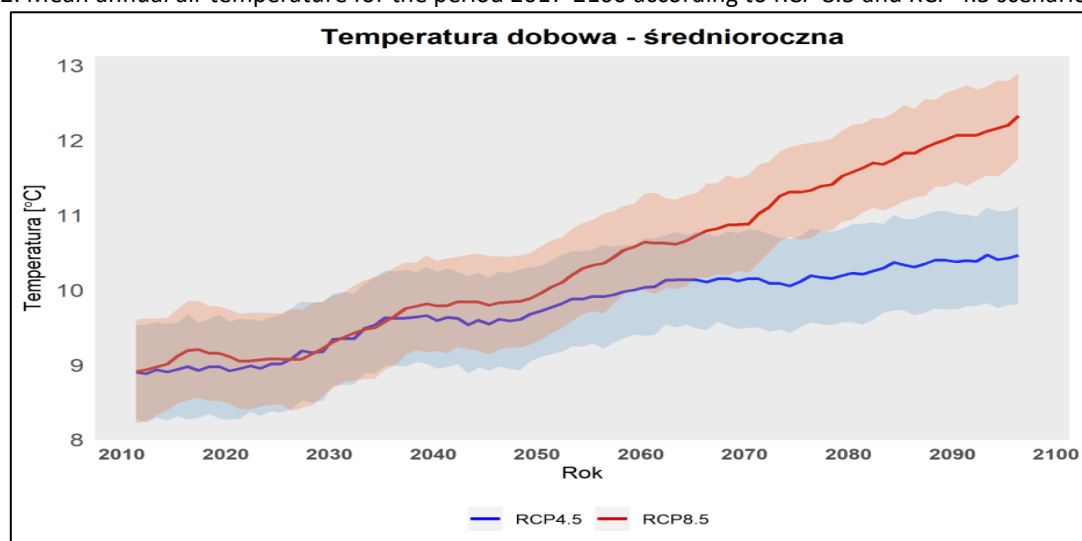
The average annual air temperature in Poland shows an increasing trend by the end of the 21st century (Fig. 52) by 1.3°C according to the RCP4.5 scenario, and even by more than 3°C according to the RCP 8.5 scenario, compared to the 2011-2020 multiyear period. The projected temperature change in both

⁹³ <https://euro-cordex.net/>

⁹⁴ Strużewska J. et al. 2020 Summary Report. Temperature and precipitation changes in Poland under future climate conditions until the year 2100; <https://ios.edu.pl/wp-content/uploads/2022/12/raport-skrocony-260121.pdf>

scenarios is fairly consistent up to 2035. Much larger temperature changes become apparent in the RCP8.5 scenario in the further time horizon.

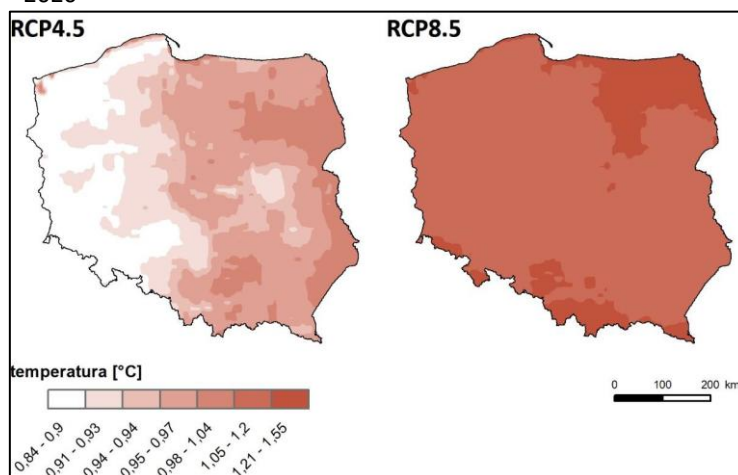
Fig. 52. Mean annual air temperature for the period 2017-2100 according to RCP 8.5 and RCP 4.5 scenarios.



Source: Strużewska J. et al. 2020 Summary Report. Temperature and precipitation changes in Poland under future climate conditions until the year 2100; IEP-NRI

The greatest changes in temperature will occur in eastern and north-eastern Poland (Fig. 53). The distribution of monthly mean temperature averaged over the area of Poland shows an increase in all seasons, with the greatest changes projected during the winter months (December, January, February) and summer months (June, July, August).

Fig. 53. Projected anomalies in annual mean temperature at 2 m above the ground, according to the RCP4.5 (left panel) and RCP8.5 (right panel) scenarios in the decade 2051—2060 compared to the multi-year period 2011—2020

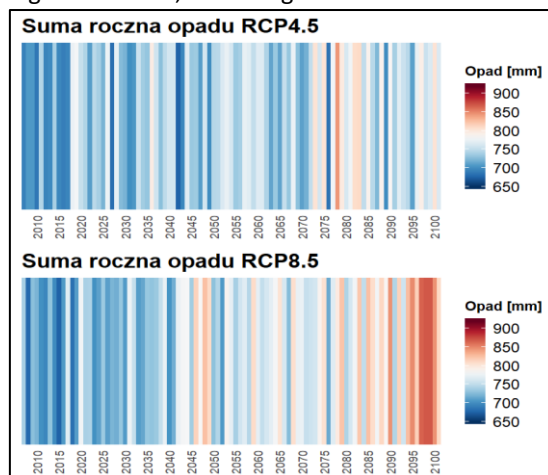


Source: Strużewska J. et al. 2020 Summary Report. Temperature and precipitation changes in Poland under future climate conditions until the year 2100; IEP-NRI

The distribution and frequency of other thermal characteristics will also change. The number of hot days (with a maximum temperature $\geq 30^{\circ}\text{C}$) per year increases by an average of 3 days (RCP4.5) to 6 days (RCP8.5) in Poland. The number of tropical nights, with a minimum temperature above 20°C , shows an increasing trend, by 2060 quite similar in both scenarios, increasing by 6-times by the end of the century compared to the current decade in the RCP 8.5 scenario. The number of cold days (with a maximum temperature $< 0^{\circ}\text{C}$) will decrease, on average, by 10 days by 2060 compared to the decade 2011—2020, especially in the east and northeast of the country.

The projected warming may intensify the hydrological cycle. Most of the modelled precipitation indicators in Poland will increase, both annual precipitation and extreme totals. Strong seasonal variability of precipitation, characterised by the occurrence of more or less wet periods, will be marked (Fig. 54).

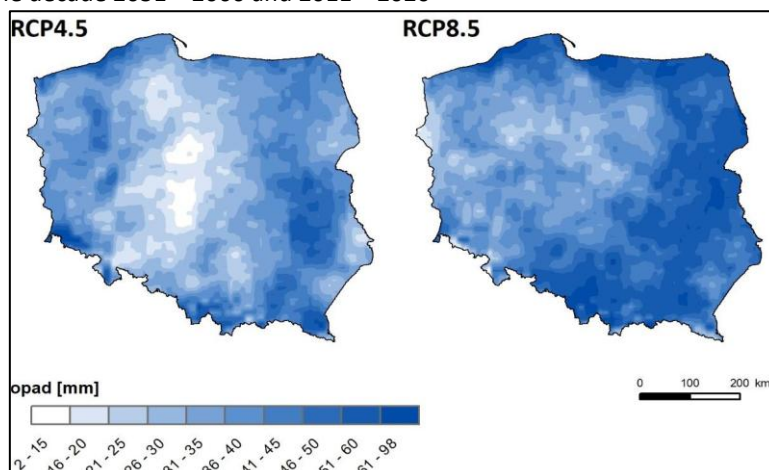
Fig. 54. Annual until 2100, averaged in Poland, according to scenarios RCP4.5 and RCP8.5



Source: Strużewska J. et al. 2020 Summary Report. Temperature and precipitation changes in Poland under future climate conditions until the year 2100; IEP-NRI

Annual precipitation will increase by the end of the century compared to the current climate by nearly 50 mm according to RCP4.5 and nearly 100 mm according to the RCP8.5 scenario. The changes will mainly occur in the eastern part of Poland, as well as mountain and coastal areas, while the increase in precipitation will be lowest in the central western areas (Fig. 55). As in the case of air temperature, future changes in precipitation will be stronger in the RCP8.5 scenario over a further time horizon.

Fig. 55. Difference in annual precipitation according to RCP4.5 (left panel) and RCP8.5 (right panel) scenarios between the decade 2051—2060 and 2011—2020



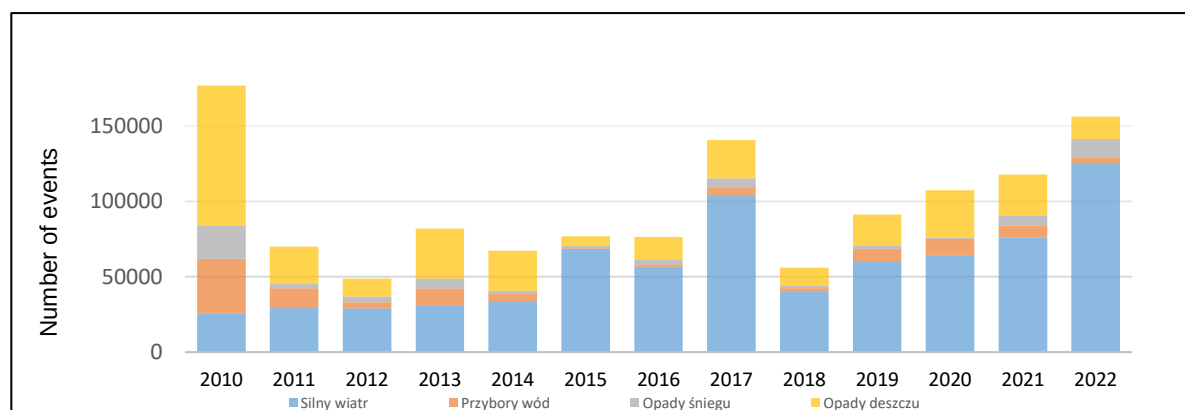
Source: Strużewska J. et al. 2020 Summary Report. Temperature and precipitation changes in Poland under future climate conditions until the year 2100; IEP-NRI

Precipitation patterns will change, mainly during the warm season. Precipitation will be more heavy, short-lasting, damaging,, causing flash floods with increasing frequency. The number of episodes of intense rainfall >20 mm/day will increase. The greatest changes in rainfall frequency and amount will occur in the north-east part of Poland, while the least significant changes will be observed in the western part of the country.

2.1.3. Extreme hazards and their consequences

With climate change, the frequency and intensity of many extreme events will increase⁹⁵. For Poland, global climate change means heat waves, severe weather events and droughts in the growing season, which is crucial for food security and the survival of natural ecosystems⁹⁶. Weather and climate extremes posing a huge threat to human health and life, infrastructure and the environment, are increasingly the cause of fire brigade interventions requiring assistance and action to deal with the consequences of damaging phenomena (Fig. 56).

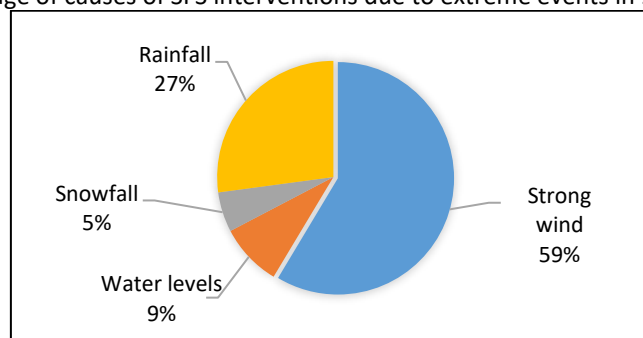
Fig. 56. Variability of local threats in Poland 2010—2022 (strong wind, water levels, snowfall, rainfall)



Source: study by IEP-NRI, based on data from the National Headquarters of the State Fire Service (SFS), 2024

Increasingly important are the threats resulting from strong winds accounting for more than 59% of interventions in the period 2010—2022. The second threat accounting for 27% of emergency service interventions is heavy rainfall.

Fig. 57. Share in percentage of causes of SFS interventions due to extreme events in 2010—2022



Source: study by IEP-NRI, based on data from the National Headquarters of the State Fire Service (SFS), 2024

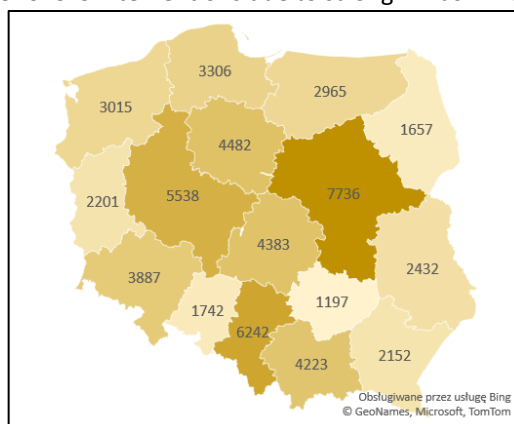
Poland is exposed to very strong winds caused by low pressure systems moving over Europe from the Atlantic. Winds of this strength are most common from November to March. When wind strength increases, storms may occur on the Baltic Sea, causing coastal damage (cliff subsidence, beach loss, damage to biotechnical buildings) and flooding at river mouths caused by backwater e.g., in Żuławy. Strong winds, very intensive rain and hail usually accompany violent storms, most of which occur between May and September. Most thunderstorms are recorded in mountains and foothill areas, but

⁹⁵ IPCC 2022 Climate change 2022: Threats, adaptation and vulnerability. Summary for policy makers; https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/Raport_IPCC_cz2_29_11_22_OST.pdf

⁹⁶ Communication 03/2024 of 16 April 2024 of the Problem Committee on Climate Crisis of the Presidium of the Polish Academy of Sciences on acceleration of global warming; https://pan.pl/wp-content/uploads/2024/04/ZmianaKlimatuCorazSilniejsza_fin_fin.pdf

also in the upland belt⁹⁷. The consequences of strong winds require assistance from emergency services, which intervene most frequently in the Mazowieckie, Śląskie, Wielkopolskie, Kujawsko-Pomorskie, Łódzkie and Małopolskie Voivodships (Fig. 58).

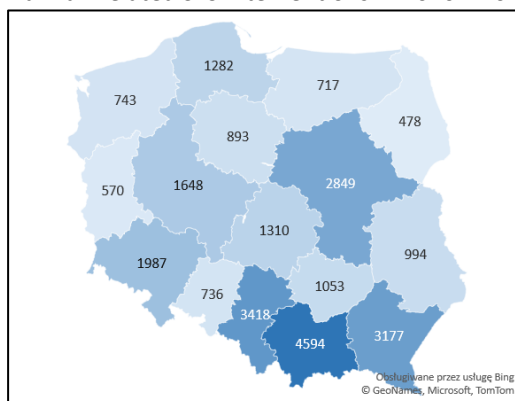
Fig. 58. Average annual number of SFS interventions due to strong winds in 2010–2022



Source: study by IEP-NRI, based on data from the National Headquarters of the State Fire Service (SFS), 2024

Due to the more frequent occurrence of intense precipitation, the threat of flooding, which is an extreme, often violent phenomenon, is increasing. Floods occur irregularly throughout Poland, and are particularly dangerous in mountain and submontane areas, where they lead to significant damage through slope erosion, landslides and the destruction of tree stands. Increased frequency of heavy rains causing rapid surges and slope erosion intensifies transport of dragged and carried material, silting up river beds and reservoirs. This promotes their shallowing and increases the risk of flooding. Intense rainfall in urbanised areas results in flooding and flash floods. The areas most at risk from heavy or prolonged rains are the southern areas of the Małopolskie, Śląskie, Podkarpackie, Dolnośląskie and Mazowieckie Voivodships (Fig. 59).

Fig. 59. Average annual number of rainfall-related SFS interventions in 2010–2022

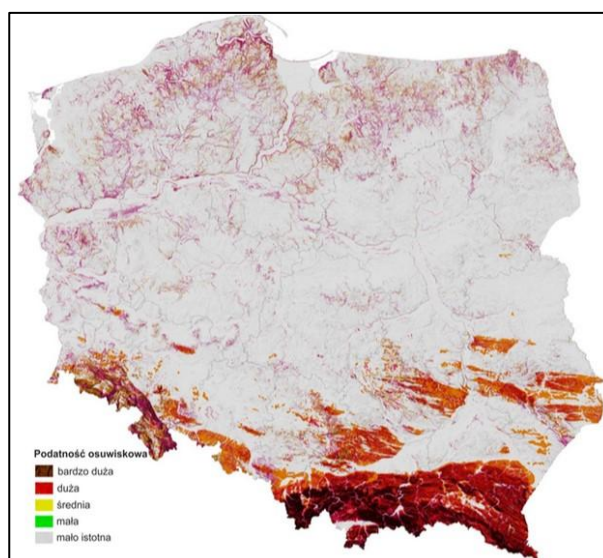


Source: study by IEP-NRI, based on data from the National Headquarters of the State Fire Service (SFS), 2024

Rainfall combined with wind most often leads to water surges, flooding or landslides. The area particularly vulnerable is southern Poland, especially slopes in the Carpathian Mountains (90% of landslides in Poland), and to a lesser extent steep river slopes and upland areas (Fig. 60). Landslides are among the most dangerous and common geohazards in Poland. They cause damage to infrastructure, crops, stands of trees and general degradation of areas affected by mass earth movements. Landslides cause huge losses every year, but above all they threaten the livelihoods and even the lives of local residents.

⁹⁷ <https://imgw.isok.gov.pl/mapy-zagrozen-i-ryzyka>

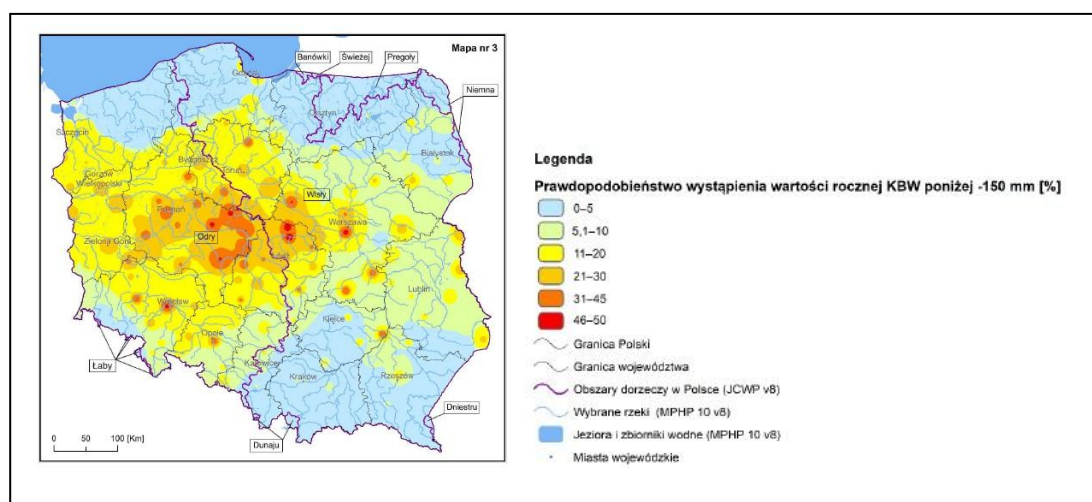
Fig. 60. Landslide vulnerability of Poland



Source: osuwiska.pgi.gov.pl (Wojciechowski et al., 2015)

The phenomenon of drought has intensified in recent years, becoming an increasing problem due to environmental and economic damage, nuisance and even danger to the population. Longer rain-free periods and higher air temperatures causing increased evaporation are direct causes of drought. An increased threat of severe atmospheric drought occurs in central and western Poland, where the probability of an annual climatic water balance (CWB) value below -150 mm is 47%, which in extreme cases means a very severe atmospheric drought every 2—3 years on average (Fig. 61).

Fig. 61. Map of probability of CWB annual value below -150 mm (1987—2018)

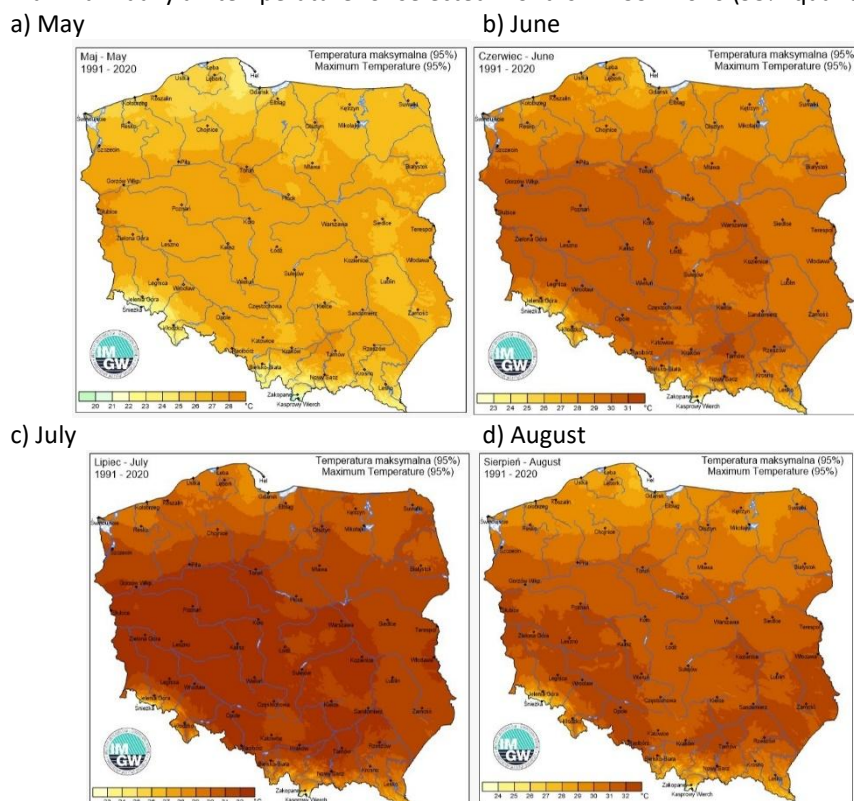


Source: *Drought counteracting plan, 2021*

It is projected that in the coming years, the main threats associated with climate change in Poland will be droughts that negatively affect crops and lead to a decline in yields, as well as heat waves and drinking water shortages, which according to an extreme scenario could affect up to 15 million of Poles.

Hot weather ($T_{max} \geq 30^{\circ}\text{C}$) in Poland falls between June and August, occasionally being recorded in September, May and even April. The highest number of hot days occurs in the Polish Lowlands (an average of 5 to 7 days per year), the least on the Baltic coast, in Pomerania and mountainous areas.

Fig. 62. Values of maximum daily air temperature for selected months in 1991-2020 (95% quantile value)



2.1.4. Effects of climate change on the Baltic Sea

With climate change, it is expected that the temperature of the Baltic Sea's surface water layer will rise, mostly during summer in the Gulf of Bothnia and the Bothnian Sea, and in spring in the Gulf of Finland. By the end of the 21st century, the water in the Sea will be warmer in summer by about 2°C in the south of the basin, and about 4°C in the northern part⁹⁸. Changes in the temperature of the near-surface water layer will increase the thermal stratification of the sea⁹⁹.

Projected climate change is likely to reduce the salinity of the Baltic Sea. The largest changes will occur in the Danish Straits region, and the smallest on the North and East Baltic. Projected changes in marine salinity are due to changes in river runoff. It is projected to increase by several to several percent throughout the catchment area¹⁰⁰.

The sea level in the southern Baltic region is rising steadily. The rate of rise varies, higher in the eastern part of the Coast. Since the middle of the 20th century, the average sea level has risen by 14.1 cm in Świnoujście and 16.3 cm in Władysławowo due to the dominance of the western zonal atmospheric circulation in this area [Fig. 63(a) and (b)]¹⁰¹. Forecasts of the magnitude of the rise in the level of the

⁹⁸ HELCOM, 2013. Climate change in the Baltic Sea Area: HELCOM thematic assessment in 2013. Balt. Sea Environ. Proc. No. 137.; <https://www.helcom.fi/wp-content/uploads/2019/10/BSEP137.pdf> <https://www.helcom.fi/wp-content/uploads/2019/10/BSEP137.pdf>

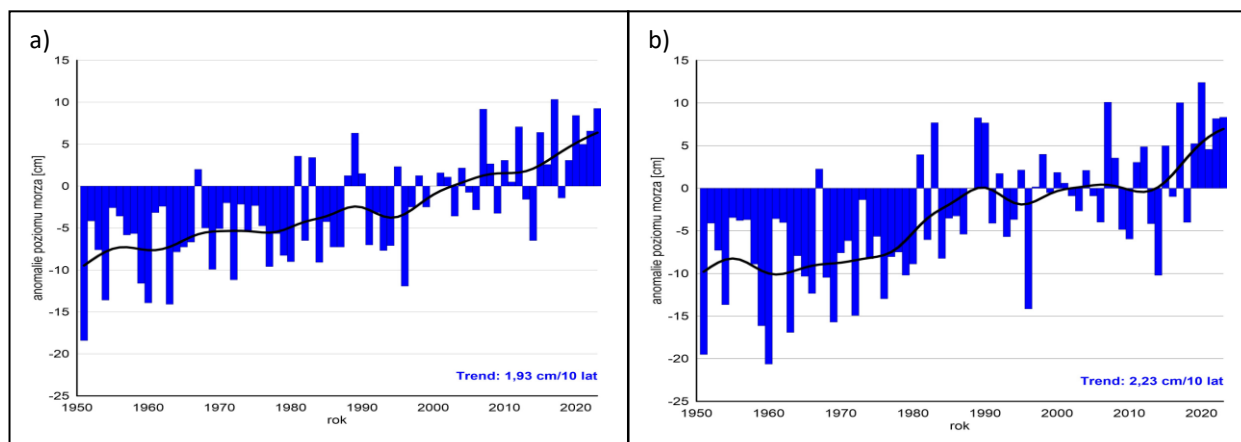
⁹⁹ Hajto M. (ed.), Bojanowicz-Babłok A., Kornatowska B., Skotak K., Kuśmier A., Marcinkowski M., Lisowska-Mieszkowska E., Potapowicz I., Biłłasiak M., Bielczyńska A., Bratkowski J., Kolada A., Ochocka A., Pasztaleniec A., Romańczak A., Sadowski M., Siwiec E., Legutko-Kobus P., 2023, Environmental trends in the framework of the National Development Concept 2050. National trends. IEP-NRI. Warsaw.

¹⁰⁰ Ibidem.

¹⁰¹ Climate of Poland 2023, IMGW-PIB, 2024

Baltic Sea in the 21st century vary widely, ranging between 0.6 and 1.1 m¹⁰², depending on the modelling approach adopted, the level of confidence and uncertainty.

Fig. 63. Baltic Sea level anomalies in 1951-2023: a) Świnoujście; b) Władysławowo



Source: *Climate of Poland 2023*, IMGW-PIB, 2024

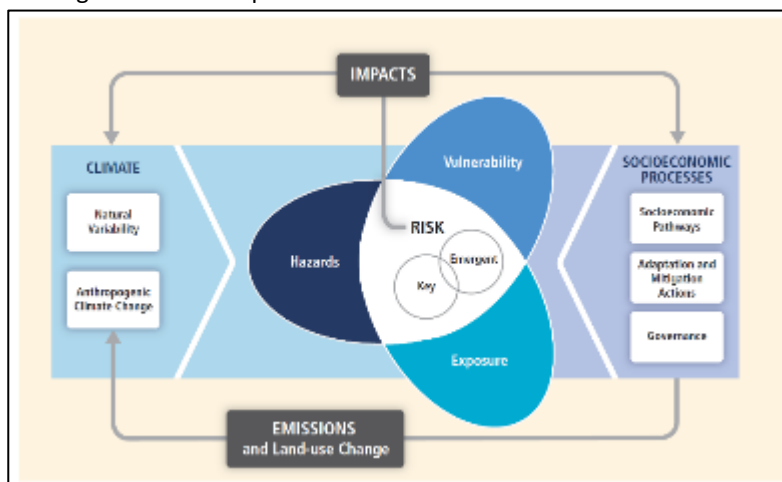
2.2. Observed and potential impacts of climate change, including economic, social and environmental vulnerabilities

2.2.1. Method of assessing climate vulnerability and risk

Both natural climate variability and anthropogenic human influence on the climate system increase the risk of climate hazards and their consequences. The basis for assessing the current and potential impacts of climate change is to conduct an adequate and broad diagnosis of the key factors affecting the level of climate risk and thus the potential negative consequences for humans, the environment and the economy. Climate risk is understood as a combination of three elements (1) threat, (2) vulnerability and (3) exposure (Fig. 64). Climate risk assessment requires consideration of the possible interactions between climate threats, vulnerability and exposure of socioeconomic systems and ecosystems to these threats.

¹⁰² Hajto M. (ed.), Bojanowicz-Bablok A., Kornatowska B., Skotak K., Kuśmierz A., Marcinkowski M., Lisowska-Mieszkowska E., Potapowicz I., Bidłasik M., Bielczyńska A., Bratkowski J., Kolada A., Ochocka A., Pasztaleniec A., Romańczak A., Sadowski M., Siwiec E., Legutko-Kobus P., 2023, Environmental trends in the framework of the National Development Concept 2050. National trends. IEP-NRI. Warsaw.

Fig. 64. The concept of climate risk



Source: IPCC 2014

The climate risk analysis method includes statistical and spatial analysis¹⁰³. It is a multi-criteria assessment - it takes into account multiple indicators that characterize three elements: (1) threat, (2) vulnerability, (3) exposure – and standardized – each index is standardized with its statistical distribution. Indicators are selected according to the problem e.g., the threat of heat on human health. The indicators are given a weight separately for each of the three elements mentioned. The standardized indicators take a value from 0 to 1. A standardized index is calculated for each element – for threat (RH index), vulnerability (RV index) and exposure (RE index). The risk index (PIR index) is the result of these three indicators¹⁰⁴. The risk index values determine its level on a five-point scale: an index value of 1 indicates no risk, 2 – low risk, 3 – moderate risk, 4 – high risk and 5 – very high risk.

The climate change risk analysis was conducted for the area of Poland as part of the Klimada 2.0 project. The spatial unit of analysis is the municipality (NUTS 5) according to the Nomenclature of Territorial Units for Statistics.

Climate threats and risk levels are developed for two climate scenarios RCP 4.5 and RCP 8.5 by decade for the period 2011-2100. The results of EuroCORDEX regional climate models¹⁰⁵, using dynamic scaling techniques to increase spatial resolution, are included. Climate data are developed for the Polish area in a regular grid with a resolution of 0.11° (about 12.5 km) for 60 climate indicators¹⁰⁶. Exposure and vulnerability are developed for the current state.

The climate risk assessment covers the sectors of public health, road transport, water management, agriculture, tourism, forests and biodiversity. The risk analysis includes a total of more than 150 indicators that characterize threats, vulnerability and exposure¹⁰⁷.

The results of the climate risk analysis for the whole of Poland have been shared as a tool on the Klimada 2.0 project portal (Fig. 65). Municipalities can use the results of the threat, vulnerability, exposure and risk analysis as a starting point for climate diagnosis in local adaptation plans.

¹⁰³ <https://klimada2.ios.gov.pl/wp-content/uploads/2022/12/Ryzyko-zmian-klimatu-metodyka-2022.pdf>

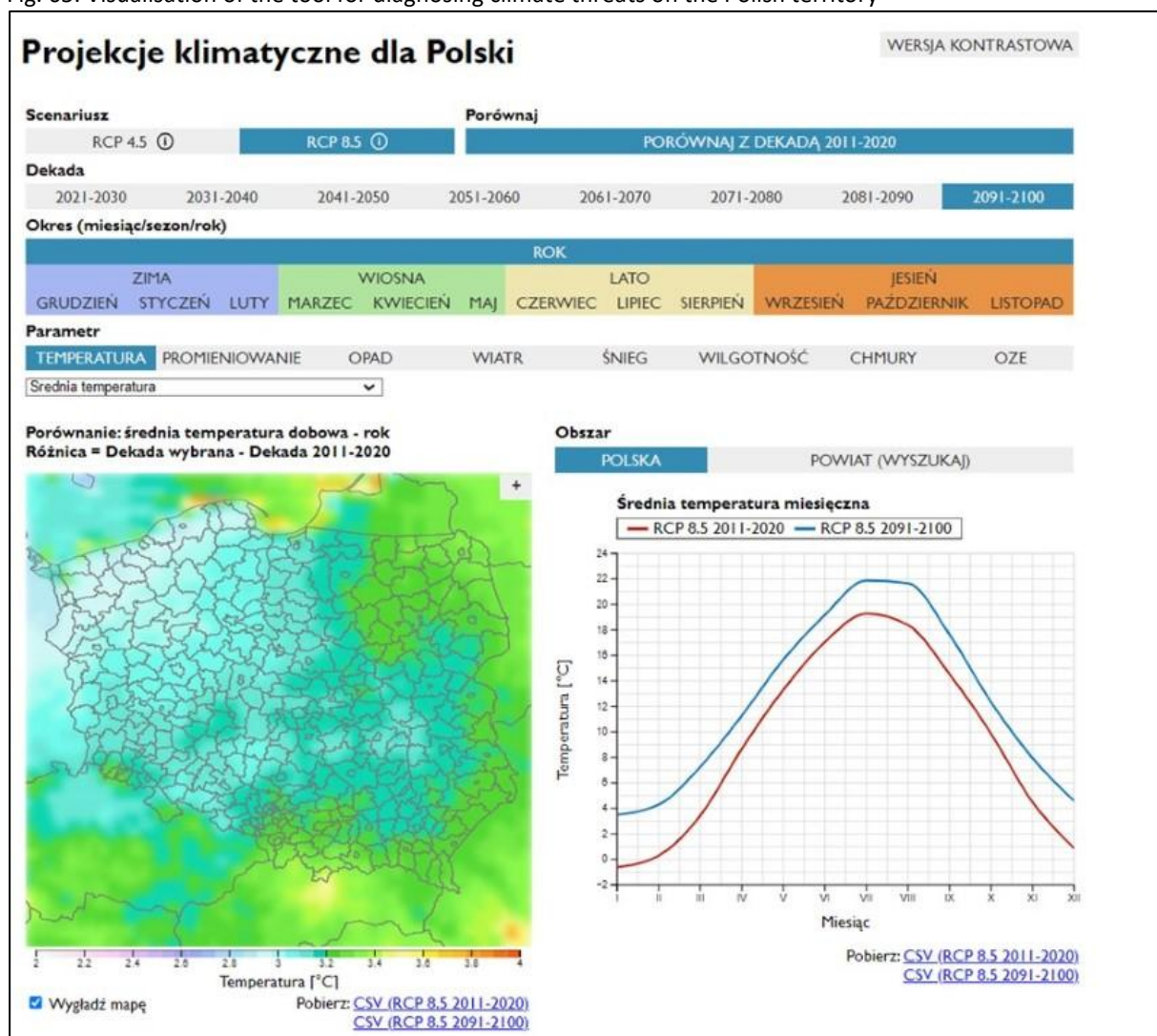
¹⁰⁴ Ibidem.

¹⁰⁵ <https://euro-cordex.net/>

¹⁰⁶ <https://klimada2.ios.gov.pl/definicje-indeksow-klimatycznych/>

¹⁰⁷ <https://klimada2.ios.gov.pl/wp-content/uploads/2022/12/Ryzyko-zmian-klimatu-wskazniki-i-zrodla-danych-2022.pdf>

Fig. 65. Visualisation of the tool for diagnosing climate threats on the Polish territory



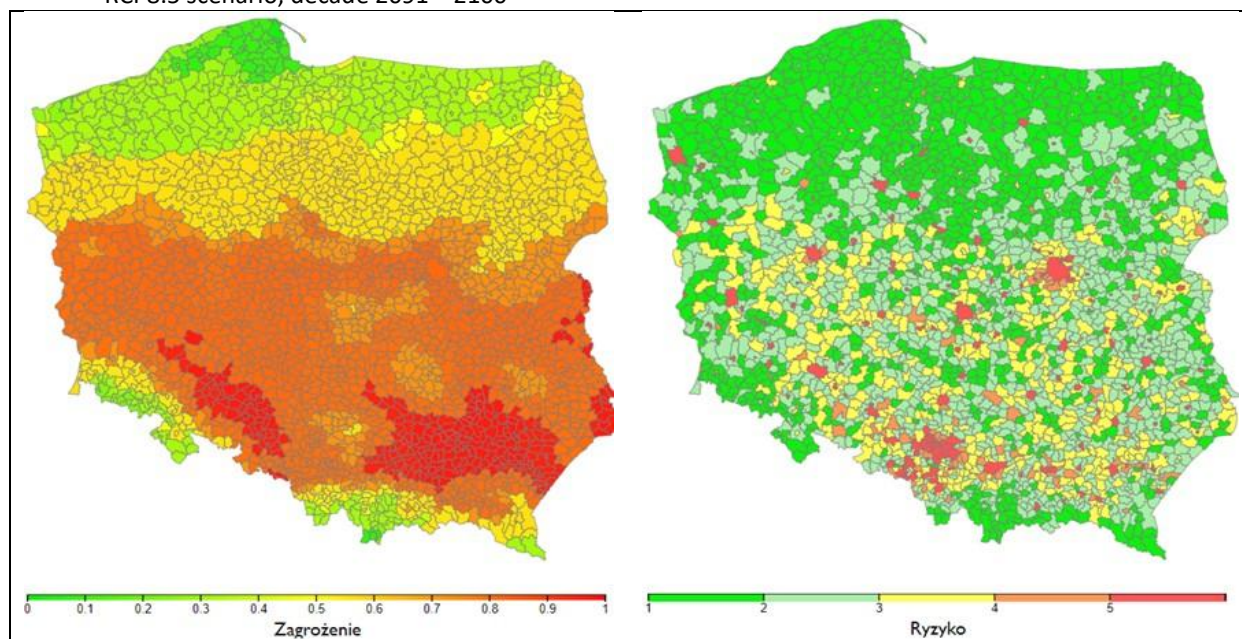
Source: <https://klimada2.ios.gov.pl/klimat-scenariusze/>

2.2.2. Sectoral, social and environmental vulnerability to climate change

Diagnoses carried out for Poland indicate that with climate change there is an increase in the intensity and frequency of extreme weather and climate phenomena with serious impacts on human health, ecosystems, infrastructure and the country's economy. Key climate threats include heavy rains, heat waves, droughts. Threats following strong winds are also becoming important. Climate threats will negatively affect each of the key economic sectors, from health care to agriculture, transportation, tourism and the environment (including biodiversity).

For the **public health sector**, 4 risks with the potential for significant impacts were defined: heat, cold, flooding and flash floods, and the threat of vector-borne diseases. Risks with exposure and vulnerability for each municipality were determined using the demographic, socioeconomic and health characteristics of the population and potential of the area, including land use and access to health care.

Fig. 66. Visualisation of standardized scores for threat and risk of heat over Poland for the public health sector, RCP8.5 scenario, decade 2091—2100



Source: <https://klimada2.ios.gov.pl/wizualizacje-ryzyka-dla-polski/>

An assessment of the health effects of climate change in Poland was conducted by the National Institute of Public Health – National Institute of Hygiene – National Research Institute, as part of the project entitled *'Study and assessment of the impact of climate change and the development of actions related to adaptation to climate change'*¹⁰⁸, aimed at assessing the health risk and vulnerability of the population in Poland with regard to parasitic, bacterial and viral infections, the occurrence of which may be related to climate change (occurrence of infections of *Legionella* aetiology and study of the occurrence of *Legionella* bacilli in environmental waters, occurrence of potentially pathogenic *Vibrio* comma in the coastal waters of the Polish Baltic Sea, threat of vector-borne diseases). Relationships between climatic factors and diseases and health emergencies were also analysed. The research, published in the final report¹⁰⁹, showed a close association of the number of deaths with heat waves and increases in temperature above the optimum (range 17-25°C), including deaths among the elderly, with large spatial variation. Importantly, there was no statistically significant effect of maximum air temperature on the change in the daily number of all-cause and cardiovascular hospital admissions.

Table 87. Averaged relative risks in the study populations associated with a 1°C rise in max. temperature above the optimum temperature and with the occurrence of a heat wave, 1998—2016

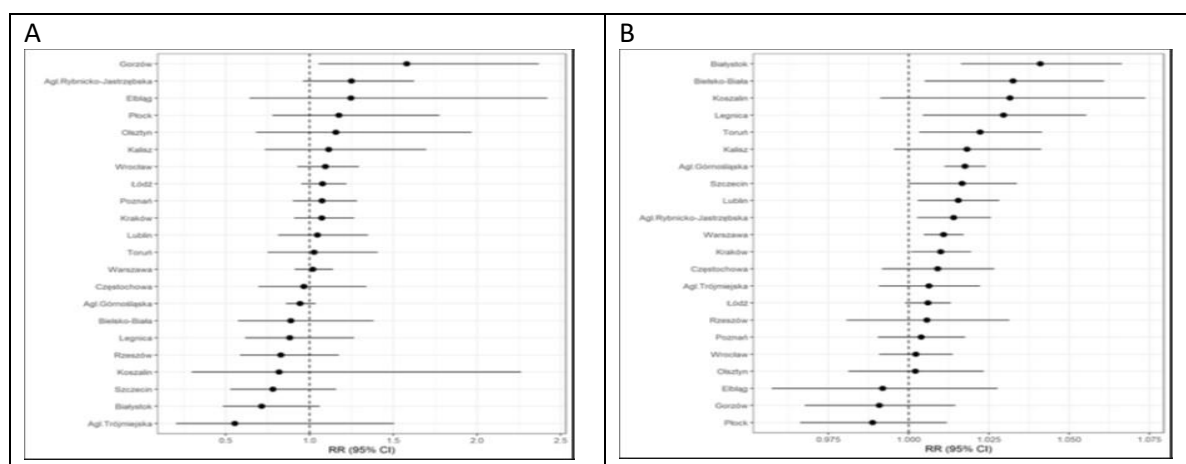
Population	Rise of temperature above optimum	Heat wave
Total	1.015 (1.014 – 1.017)	1.050 (1.020 – 1.080)
0—64 years	1.011 (1.008 – 1.013)	1.020 (0.980 – 1.070)
65 years and more	1.018 (1.016 – 1.021)	1.070 (1.030 – 1.110)
Women	1.016 (1.014 – 1.019)	1.040 (0.996 – 1.080)
Men	1.015 (1.013 – 1.018)	1.050 (1.001 – 1.100)

Source: https://www.pzh.gov.pl/wp-content/uploads/2021/02/Raport-koncowy_dzialanie-7_2020-12-31.pdf

¹⁰⁸ <https://www.pzh.gov.pl/klimat/#>

¹⁰⁹ https://www.pzh.gov.pl/wp-content/uploads/2021/02/Raport-koncowy_dzialanie-7_2020-12-31.pdf

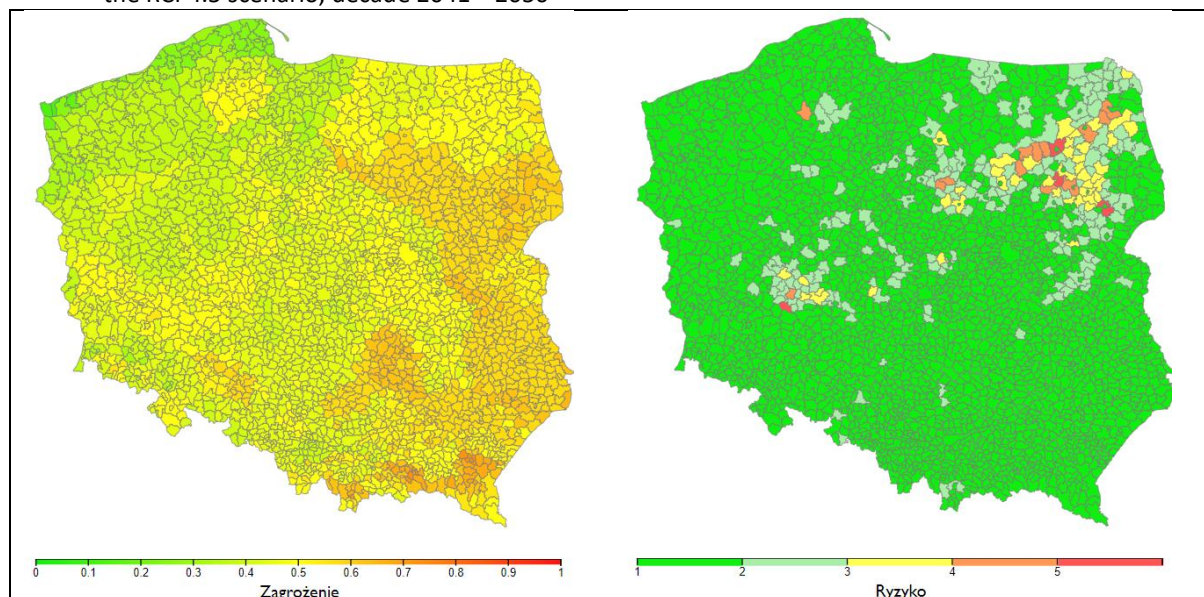
Fig. 67. Risk of death in the population aged 0—64 years due to all causes excluding external causes associated with a heat wave (A) and with a temperature rise of 1°C above the optimum (B)



Source: https://www.pzh.gov.pl/wp-content/uploads/2021/02/Raport-koncowy_dzialanie-7_2020-12-31.pdf

In the report, public health experts summarised that climate change significantly affects the dynamics of vector-borne, water, food, rodent and airborne infectious diseases. Warming favours the survival and transmission of pathogens and vectors of these pathogens, determines the geographic distribution of tick species, their density and population dynamics, increasing the likelihood of human and animal infection by pathogenic microorganisms.

Fig. 68. Visualisation of standardised results of threat and risk assessment for livestock production in Poland in the RCP4.5 scenario, decade 2041—2050

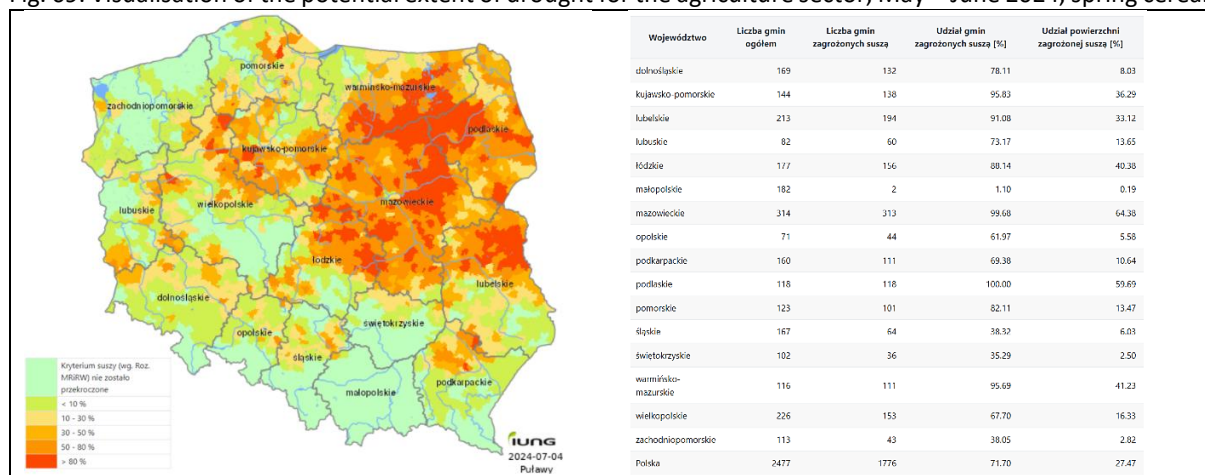


Source: <https://klimada2.ios.gov.pl/wizualizacje-ryzyka-dla-polski/>

For the **agriculture sector**, three groups of activities were included in the climate risk analysis, namely livestock production (including fodder crops), crop production, fruit and vegetable production. Climate threats that could cause significant impacts were defined for the indicated activities: length of the growing season, heat, drought and water shortages, spring frost. The risk considering exposure and vulnerability for each municipality was determined using the characteristics of the areas devoted to crops, detailing the land use, animal population, plant protection product treatments and agricultural infrastructure and economic potential (Fig. 68).

A dedicated Agricultural Drought Monitoring System that precisely identifies areas with crop drought losses has been developed by the Institute of Soil Science and Plant Cultivation - National Research Institute in Puławy^{110, 111}. The tool is based on climatic water balance below a certain value for individual crop species or groups (14 categories are available) and soil categories. Data are provided in the form of maps and aggregated values for voivodships detailing the number of municipalities affected by drought in selected periods.

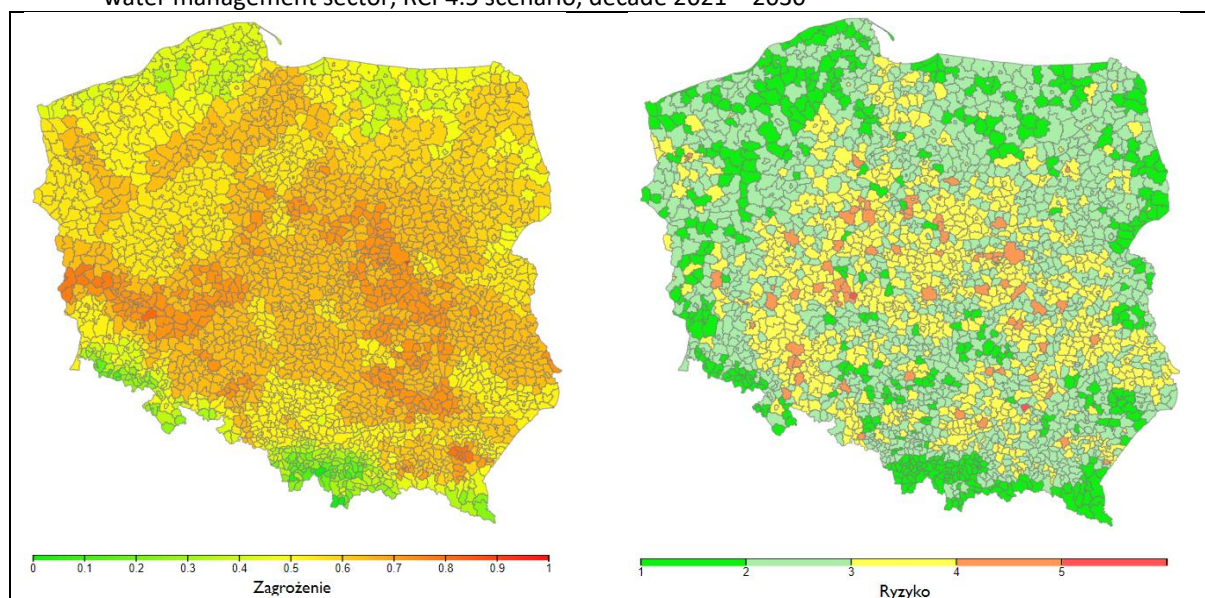
Fig. 69. Visualisation of the potential extent of drought for the agriculture sector, May—June 2024, spring cereals



Source: <https://susza.iung.pulawy.pl/mapy/>

For the water management sector, the climate risk analysis was conducted towards the risks of water scarcity, local flash floods, flooding, infrastructure damage and performance. With threats, the characteristics of rainfall, cold, heat, surface runoff and water content in the soil profile were taken into account. Risks with exposure and vulnerability for each municipality were determined using data on rivers, reservoirs, flood control infrastructure, land use (including permeable surfaces), network failures and the economic potential of the municipalities for water and wastewater management.

Fig. 70. Visualisation of the standardised results of the threat and risk assessment of water scarcity for the water management sector, RCP4.5 scenario, decade 2021—2030



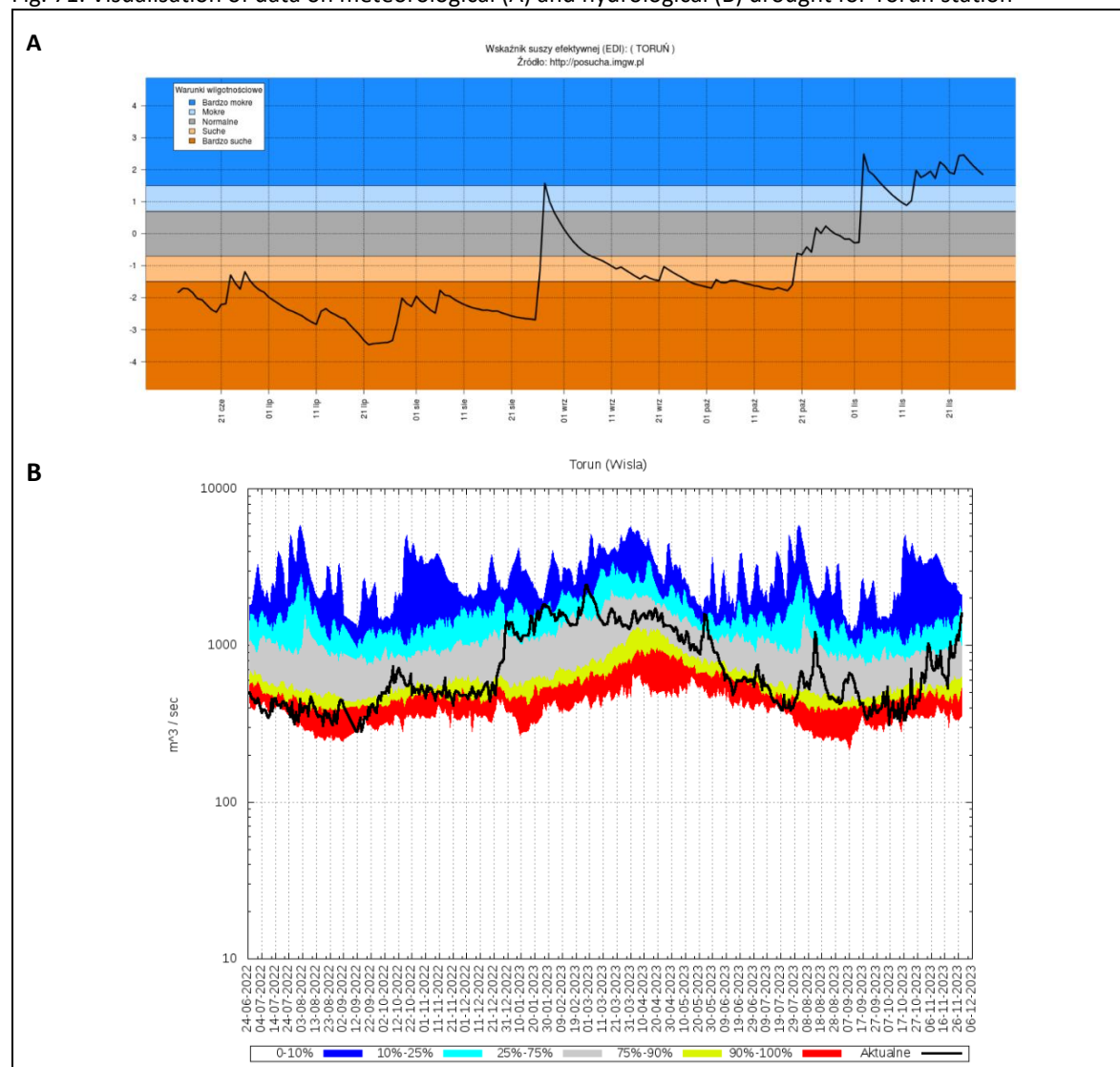
Source: <https://klimada2.ios.gov.pl/wizualizacje-ryzyka-dla-polski/>

¹¹⁰ <https://www.gov.pl/web/rolnictwo/system-monitoringu-suszy-rolniczej>

¹¹¹ <https://susza.iung.pulawy.pl/>

A dedicated system covering water scarcity, hydrological and meteorological drought data was developed by the Institute of Meteorology and Water Management - National Research Institute¹¹² and the State Water Holding 'Polish Waters'¹¹³. The tool of the IMGW-PIB is based on measurement data from monitoring of hydrological indicators and data from the Satellite Application Centre for Operational Hydrology and Water Management. Data are provided in the form of graphs (Fig. 71).

Fig. 71. Visualisation of data on meteorological (A) and hydrological (B) drought for Toruń station



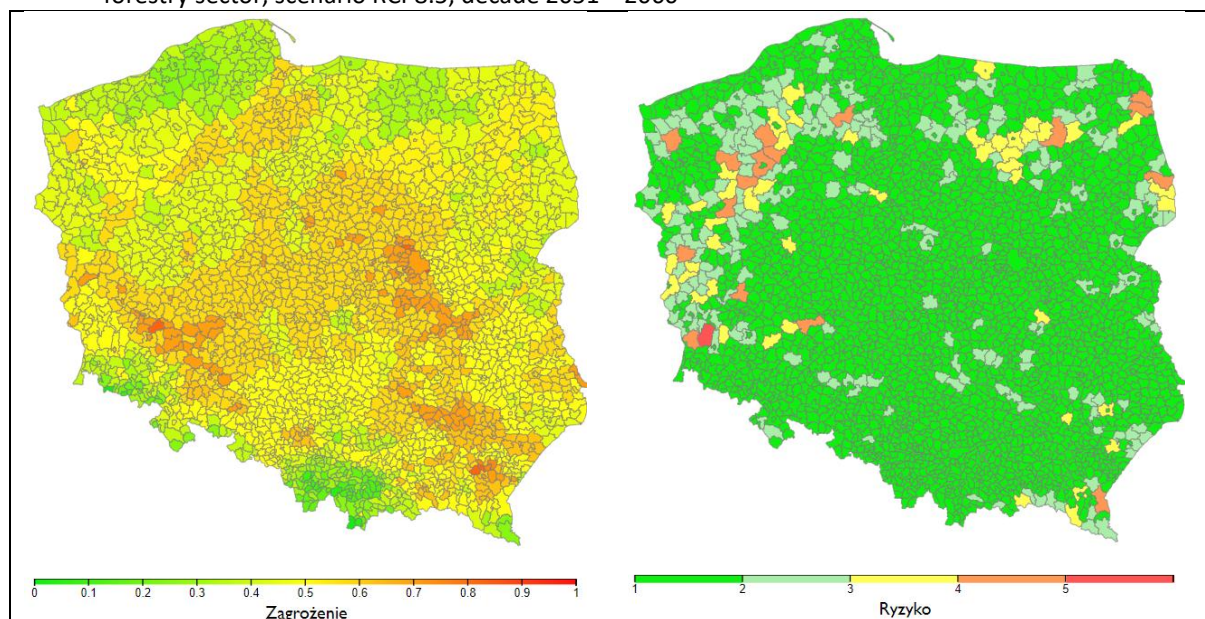
Source: <https://stopsuszy.imgw.pl/>

Another sector suffering from the negative effects of drought due to climate change, and for which a climate risk assessment has been prepared, is **forestry**. Rainfall characteristics and the water content of the soil profile were considered in the threat analysis for this sector. The risk with exposure and vulnerability for each municipality was determined using data on the area occupied by forests, forest types, forms of protection and forest management (management units) (Fig. 72).

¹¹² <https://stopsuszy.imgw.pl/>

¹¹³ <https://stopsuszy.pl/>

Fig. 72. Visualisation of standardised results of the assessment of threat and risk of drought in Poland for the forestry sector, scenario RCP8.5, decade 2051—2060



Source: <https://klimada2.ios.gov.pl/wizualizacje-ryzyka-dla-polski/>

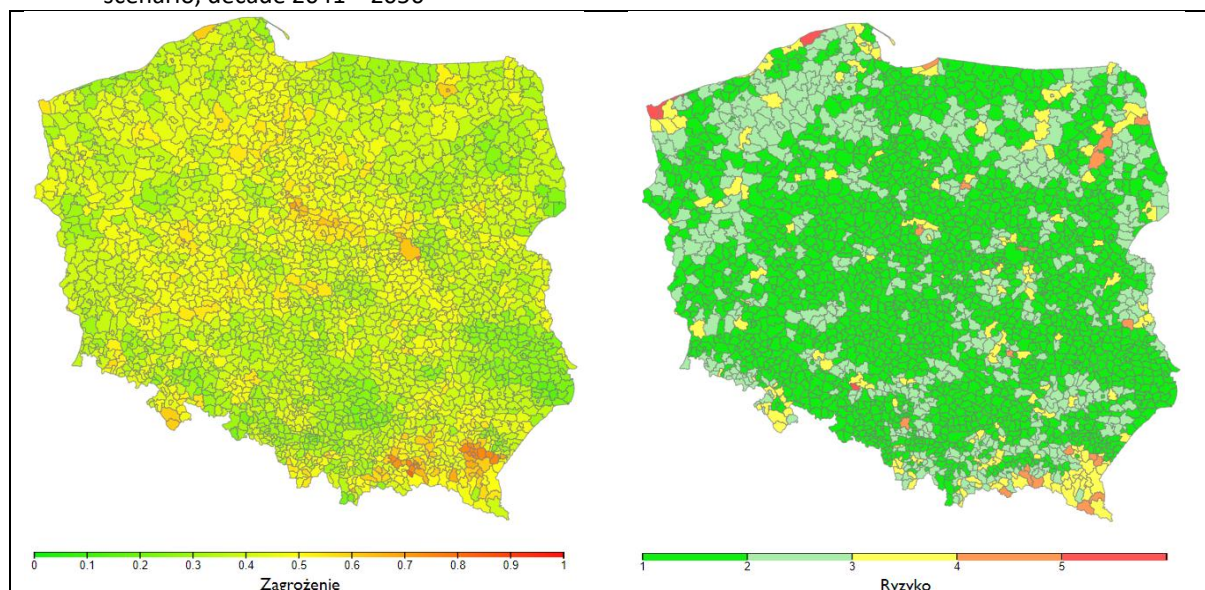
Projects carried out by the State Forests National Forest Holding and its subordinate unit, the Coordination Centre for Environmental Projects, have shown that for forestry, the greatest climate change impacts, apart from drought¹¹⁴, are caused by forest fires¹¹⁵.

The climate risk to **biodiversity** associated with drought, that is, the largest identified threat, was also assessed (Fig. 73). Precipitation characteristics and water content of the soil profile were included in the assessment. The risk was determined considering the exposure of different ecosystem types and the vulnerability of each municipality using data on the presence of forms of nature conservation in the municipality (national park, nature reserve, landscape park, protected landscape area), the area of ecological corridors and the pressure of development on protected areas and ecological corridors, and the expenditure allocated to environmental protection in the total expenditure of the municipality, as an adaptation potential.

¹¹⁴ <https://www.ckps.lasy.gov.pl/adaptacja-na-terenach-nizinnych>

¹¹⁵ <https://www.ckps.lasy.gov.pl/ochrona-przeciwpozarowa>

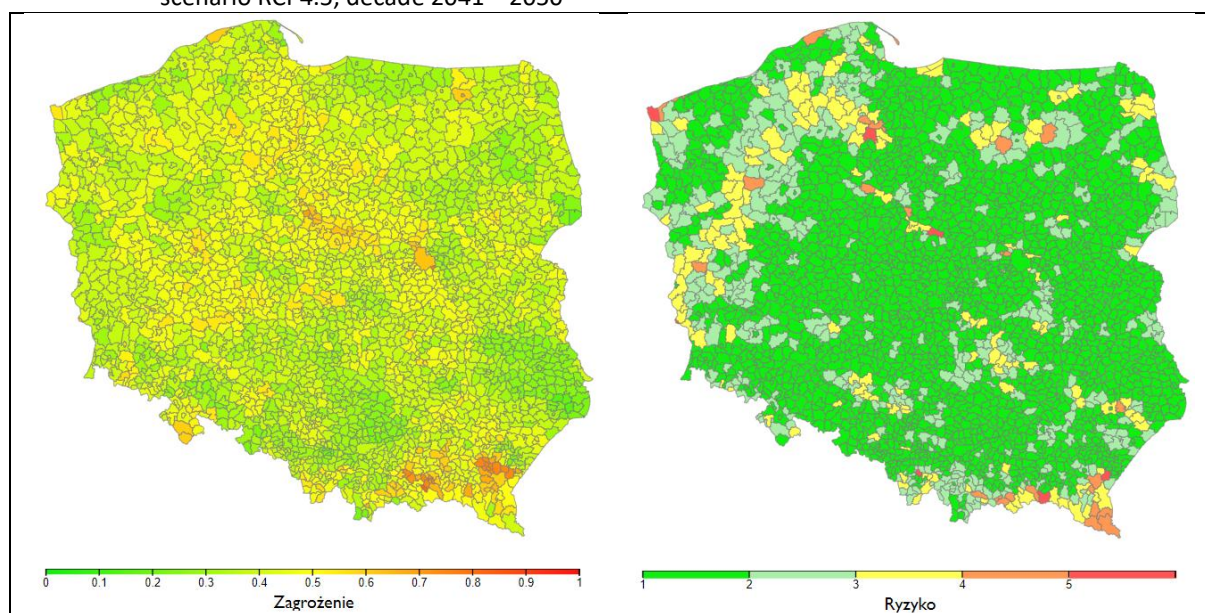
Fig. 73. Visualisation of standardised results for threat and risk of drought in Poland on biodiversity, RCP4.5 scenario, decade 2041–2050



Source: <https://klimada2.ios.gov.pl/wizualizacje-ryzyka-dla-polski/>

A climate risk analysis of the **tourism sector** was carried out towards the risks of lack of snow cover (winter tourism) and droughts (summer tourism). The assessment took into account precipitation characteristics, cold, heat and changes in snow cover duration and thickness. Risk with exposure and vulnerability for each municipality was determined using data on the share of ecosystem area with high potential for tourism and sightseeing services and services related to the preservation and protection of natural cultural heritage, the occurrence of forms of nature conservation, the share of aquatic and water-dependent ecosystem area and the potential to incur tourism expenditure as a proportion of total municipal expenditure (Fig. 74.).

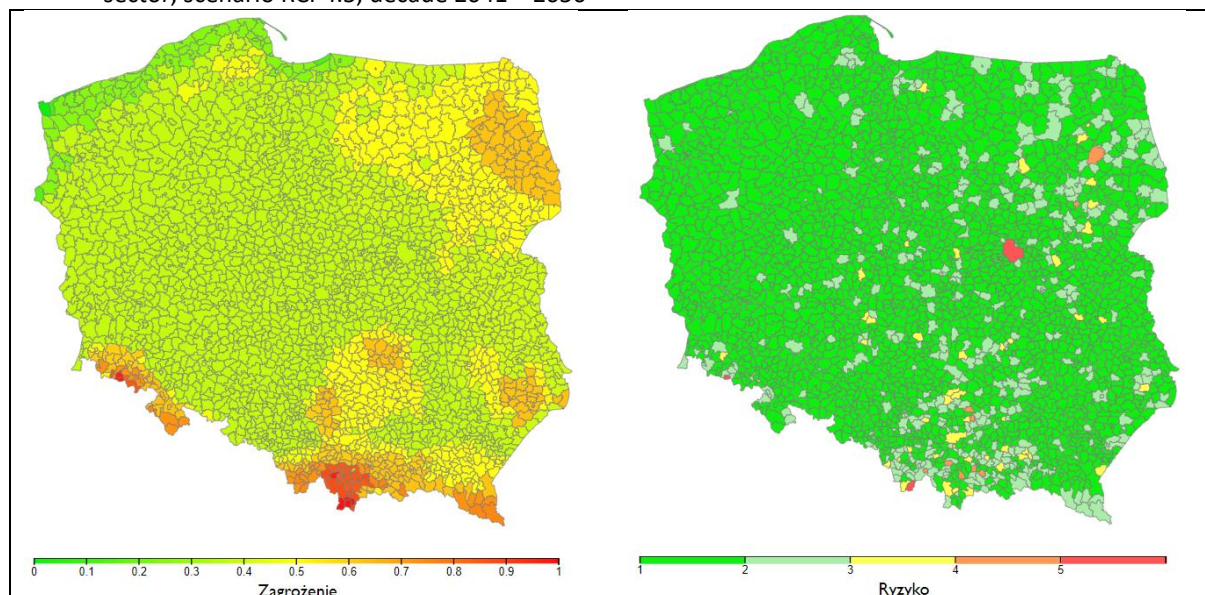
Fig. 74. Visualisation of standardised results for threat and risk of drought in Poland for the tourism sector, scenario RCP4.5, decade 2041–2050



Source: <https://klimada2.ios.gov.pl/wizualizacje-ryzyka-dla-polski/>

Another sector subjected to a climate risk assessment is **road transport**. In this case, heat, cold, ice, floods and flash floods were identified as the greatest threats. Thermal and precipitation characteristics were used in the assessment. Risk with exposure and vulnerability for each municipality was determined using data on road densities by type and management, type of pavement, risk for roads existing in areas with specific probability of flooding and potential related to road maintenance.

Fig. 75. Visualisation of standardised results for the threat and risk of road ice in Poland for the road transport sector, scenario RCP4.5, decade 2041—2050



Source: <https://klimada2.ios.gov.pl/wizualizacje-ryzyka-dla-polski/>

3. Priorities and adaptation barriers

3.1. National priorities

The main objective of adaptation to climate change in Poland is to ensure sustainable development and effective functioning of the economy and society under conditions of climate change, as expressed in the national 'Strategic adaptation plan for sectors and areas vulnerable to climate change by 2020 with the prospects until 2030'¹¹⁶. This will be achieved through the implementation of specific objectives and priority directions of adaptation measures in the most vulnerable areas: water management, agriculture, forestry and biodiversity, and urban areas.

Increasing the resilience of society, economy and environment to the impacts of climate change means:

- Ensuring energy security and good environmental status;
- Effective adaptation to climate change in rural areas;
- Developing transport under climate change conditions;
- Ensuring sustainable regional and local development taking into account climate change;
- Stimulating innovation conducive to climate change adaptation;
- Shaping societal attitudes conducive to climate change adaptation.

3.2. Adaptation challenges and gaps and barriers to adaptation

Problems and challenges related to the country's development under changing climate are identified already at the stage of developing the assumptions of strategic and programme documents (the diagnosis element), as well as the entire preparation and monitoring of the implementation of strategies for adaptation to climate change. Among them, the following have been identified as the most important for increasing the resilience of the economy and society to the negative effects of change:

Insufficient data and information on climate change and its impacts

Adapting to climate change requires knowledge- and data-driven policies. Available data on climate change are not complete and sufficiently up-to-date. Data and information on the effects of climate change on the economy, society and ecosystems are insufficiently collected. Scientific findings on the effects of climate change are scattered. The quality of data hampers action planning and the preparation of specific adaptation solutions.

Deficit of methods and tools to support adaptation

The problem with effectively taking and implementing adaptation measures often stems from insufficient understanding of the importance and use of knowledge in planning and implementing such measures. A barrier is the insufficient dissemination of methods to analyse and assess the impacts of climate change on the economy and society. Tools to support adaptation policies, including to assess climate risk in shaping national development, are not sufficiently implemented. The need for IT tools and promotion of good practices is also identified. In addition, legal and financial instruments insufficiently promote climate change adaptation measures.

¹¹⁶ Strategic adaptation plan for sectors and areas vulnerable to climate change by 2020 with the prospects until 2030

Insufficient awareness and knowledge of adaptation issues

One of the biggest challenges identified is the lack of interest in, and insufficient level of understanding of, adaptation issues among those working in institutions that are (or should be) involved in implementing adaptation policies. The need to adapt to climate change is also not widely perceived in society. The low level of public awareness about the importance of adaptation needs limits public support for action taken and the involvement of local communities for the common good.

Ineffective adaptation policy coordination model

The current model is not effective for implementing and monitoring adaptation measures. A change in the coordination modality should move towards greater involvement of stakeholders, including public administration actors, for adaptation measures. Therefore, a new model for coordinating the implementation of adaptation measures seems to be needed, including - a designated entity with clearly defined duties and responsibilities, as well as an effective system for monitoring the implementation and testing the effectiveness of adaptation measures. Such an entity should be given a high profile in national development management.

Lack of a systemic approach to adaptation policy and response to the impacts of climate change

Adaptation to climate change should be addressed by public administrations at all levels. There is a lack of precise definition of the roles of different actors in climate change adaptation. There is a lack of stability in the division of competences and finances between state and local administrations. This also applies to crisis management, which lacks a clear definition of the tasks of individual actors, including local government.

Insufficient coordination of instruments supporting adaptation to climate change

Legal and financial instruments insufficiently promote climate change adaptation measures. The available sources of funding for development policies, including climate change-related actions, are not coordinated, making them less effective and limiting the potential for synergies in the pursuit of sustainable development.

Insufficient territorialisation

The diagnosis of vulnerability to climate change as well as the design and implementation of organisational, legal and financial instruments are insufficiently targeted at territories and their different adaptation needs.

Sectoral approach to adaptation

Despite the implementation of an integrated approach to managing national development, a sectoral approach is still in place. Organisational barriers prevent cross-cutting activities involving different actors. Adopting a horizontal approach would allow integrating actions and undertaking cooperation across sectors and between levels of public administration (central and local government).

4. Adaptation strategies, policies, plans, goals and actions to integrate adaptation into national policies and strategies

4.1. Strategic adaptation plan for sectors and areas vulnerable to climate change by 2020 with the prospects until 2030 – National adaptation policy, its objectives and priorities

The national adaptation policy is formulated in the 'Strategic adaptation plan for sectors and areas vulnerable to climate change by 2020 with the prospects until 2030'¹¹⁷. The plan was developed in 2013. It provides a comprehensive assessment of the vulnerability of climate-sensitive sectors and areas, establishes priorities for adaptation to climate change at the national level and sets out lines of action.

The main objective of the Strategic adaptation plan for sectors and areas vulnerable to climate change by 2020 with the prospects until 2030 is to ensure sustainable development and effective functioning of the economy and society under climate change conditions. The document identifies priority directions for adaptation actions to be taken by 2020 with the prospects until 2030 in the most vulnerable sectors and areas: water management, agriculture, biodiversity and forestry, as well as urban areas and the Baltic coast.

Table 88. Objectives and courses of action included in the Strategic adaptation plan for sectors and areas vulnerable to climate change by 2020 with the prospects until 2030

Specific objectives of the Strategic adaptation plan for sectors and areas vulnerable to climate change by 2020 with the prospects until 2030	Action directions
Objective 1. Ensuring energy security and good environmental status	- Adapting the water sector to climate change; - Adapting the coastal zone to climate change; - Adapting the energy sector to climate change; - Biodiversity conservation and forest management in the context of climate change; - Climate change adaptation in land use and construction; - Ensuring the effective functioning of the health system under climate change conditions.
Objective 2. Effective adaptation to climate change in rural areas	- Establishing local monitoring and warning systems against threats; - Organisational and technical adaptation of agricultural and fishing operations to climate change.
Objective 3. Developing transport under climate change conditions	- Developing construction standards that take climate change into account; - Managing transport routes under climate change conditions.
Objective 4. Ensuring sustainable regional and local development taking into account climate change	- Environmental monitoring and early warning and response systems in the context of climate change (cities and rural areas); - Urban spatial policy taking into account climate change.
Objective 5. Stimulating innovation conducive to climate change adaptation	- Promoting innovation at the level of organisational and management actions favouring adaptation to climate change; - Building a support system for Polish innovative technologies favouring adaptation to climate change.
Objective 6. Shaping public attitudes to adaptation to climate change	- Raising awareness of the risks associated with extreme events and how to reduce their impact; - Protections of vulnerable groups from the effects of adverse climate events.

Source: study by the IEP-NRI

¹¹⁷ <https://bip.mos.gov.pl/strategie-planu-programy/strategiczny-plan-adaptacji-2020/>

Due to the horizontal nature of adaptation and the existing institutional framework of development policy in Poland, the *Strategic adaptation plan for sectors and areas vulnerable to climate change by 2020 with the prospects until 2030* does not foresee the establishment of new institutions responsible for its coordination. The Plan is implemented through sectoral strategies, policies and programmes, the implementation of which is the responsibility of individual ministries, which ensures that adaptation to climate change is integrated into national policies and strategies. The Ministry of Climate and Environment coordinates the implementation of the Plan.

In view of the observed and projected impacts of climate change, the importance of adaptation measures in international political and legal instruments and in national public policies is increasing. Taking into account the global adaptation goal set out in Article 7(1) of the Paris Agreement, it is crucial to formulate new national adaptation policies that take into account the latest climate scenarios, new socio-economic data and are in line with new policy planning methods.

The Ministry of Climate and Environment, which is responsible for the national adaptation policy, has undertaken activities related to the development of a new National Adaptation Strategy and Adaptation Action Plan (see Chapter IV.5.1. for details).

4.2. Adaptation policies in sectors and areas vulnerable to climate change

4.2.1. Urban areas

The Strategic adaptation plan for sectors and areas vulnerable to climate change by 2020 with the prospects until 2030 has indicated a direction for adaptation policy in urban areas: urban spatial policy taking into account climate change. The direction is strongly emphasised in the 'National Urban Policy 2030' (NUP 2030)¹¹⁸ adopted in 2022. The NUP 2030 identifies eleven challenges facing cities in Poland, among which almost all are related to the adaptation of cities to climate change. Reducing the negative effects of climate change in cities will be achieved by:

- introduction of a standard of protection and shaping of greenery in investment processes,
- legal empowerment of the 'blue-green infrastructure' (BGI),
- management of water resources in a catchment system,
- financial, legislative and organisational mechanisms for increasing natural retention,
- prevention of urban flooding and droughts and their consequences through legislative changes,
- introduction of a management plan for the city's blue-green infrastructure.

The Ministry of Climate and Environment supported major cities in developing urban climate change adaptation plans between 2017 and 2019¹¹⁹. This project and a number of other urbanisation projects have built capacity to shape urban adaptation policies. Between 2022 and 2023, a number of climate change adaptation plans have been developed in small and medium-sized cities. Their development is supported by EU funding and by providing local governments with knowledge on adaptation policy planning. The following are available for cities: climate change scenarios, climate risk analysis, catalogue of adaptation actions, catalogue of good practices, Climate Change Adaptation Handbook

¹¹⁸ <https://www.gov.pl/web/fundusze-regiony/polityka-miejska>

¹¹⁹ 'Development of climate change adaptation plans in cities with more than 100 000 inhabitants' (MPA44), EU-funded.

for Cities – Analyses and Tools developed within the Klimada 2.0 project¹²⁰. The planned continuation of the project (Klimada 3.0) will update climate change scenarios and further analyses to support local communities in adaptation to climate change.

The Ministry of Climate and Environment also supported cities through the '*City with Climate*' project, which provided strategic advice to selected cities.

Strengthening adaptation to climate change in cities is intended to be supported by a new legislative solution – an Act obliging cities with more than 20 000 inhabitants to develop urban adaptation plans. The draft Act¹²¹ also provides for improved monitoring of the effects of urban adaptation policy-making.

The most important action in city adaptation is the development of blue-green infrastructure. In line with NUP 2030, the Ministry of Climate and Environment is taking steps to introduce a city's BGI management plan as an implementation of the recommendation to develop an 'urban greening plan' included in the EU's 'Biodiversity Strategy for 2030'.

4.2.2. Water management

A priority in adapting water management to climate change is the further development and modernisation of flood and drought protection infrastructure in line with adopted strategies and plans, respecting the needs of society, the environment and the economy. To restore morphological continuity, restoration measures are conducted to enable the restoration and development of aquatic ecosystems.

There are following water management objectives expressed in the state policy:

- strengthening the implementation of measures aimed at achieving or maintaining at least a good ecological state of waters, improving the state of water resources and the possibilities of water use,
- strengthening the system of protection of waters and water-dependent ecosystems, in particular the Oder River after the Oder catastrophe,
- strengthening protection against the effects of drought and water scarcity by increasing water retention and by creating legal mechanisms allowing for reuse of water for irrigation in agriculture,
- improving flood protection through the implementation of both non-technical and technical investments,
- taking measures to ensure that Polish citizens have access to healthy, cheap drinking water.

The State Water Holding 'Polish Waters' is responsible for the implementation of water management policy, whose competences include the preparation of a preliminary flood risk assessment, flood risk maps and flood hazard maps, flood risk management plans, and a drought management plan. These planning documents are elements of Poland's policy to adapt to the threats of climate change.

In 2021 the Drought Effects Counteracting Plan (DECP) has been adopted. Its goal is to reduce the scale of the threat and risk posed by drought and to ensure access to water in sufficient quantity and quality. The action plan is developed using an analysis of the threat of drought, including spatial data describing the extent of areas at risk from different types of droughts. The DECP emphasises opportunities to

¹²⁰ Knowledge base on climate change and adaptation to its impacts and channels for its dissemination in the context of increasing the resilience of the economy, environment and society to climate change and counteracting and minimising the impacts of extraordinary threats', EU-funded.

¹²¹ <https://legislacja.gov.pl/projekt/12385550>

augment available water resources, proposals for the construction or reconstruction of water facilities, proposals for necessary changes in the use of water resources and changes in natural and artificial retention, and a catalogue of measures to counter the effects of drought. The DECP implements an initiative-taking approach aimed at enhancing the characteristics and processes that shape water resources in entire catchments, incorporating both technical measures and instruments of spatial planning, land and water management, protection of aquatic and water-dependent ecosystems. The improvement and restoration of natural water cycle conditions is also supported by measures to enhance natural retention. An assessment of the effectiveness of the implementation of the adaptation measures included in the DECP is scheduled for the second half of 2024.

Flood risk management is based on the 2023 updated plans (FRMPs) for six river basin districts: Vistula, Oder, Pregola, Niemen, Elbe and Danube. The objective of the FRMPs is to reduce the potential negative impacts of flooding on human life and health, the environment, cultural heritage and economic activity. The FRMPs have been developed based on climate projections taking into account long-term climate change trends and individual extreme events. The method of developing FRMPs includes analyses of the distribution of flood risks, hydraulic modelling to determine the effectiveness and efficiency of the proposed measures, cost-benefit analysis, analysis and evaluation of the compliance of the adopted final action options with environmental legal requirements, and multi-criteria analysis.

The FRMP contains measures to minimise the identified risks and reduce flood losses. These include both technical measures (e.g., construction of retention basins and embankments) and non-technical measures (e.g., natural retention and legal instruments), including proper spatial planning at the local government level. The progress in the implementation of the measures included in the FRMP was assessed as low. Insufficient funds for the implementation of the measures and the lengthiness of the investment processes were identified as the main reasons for this situation.

The main activity implemented in the area of water management is the 'Oder and Vistula River Basins Flood Protection Project', the implementation of which will last until 2025. The aim of the planned project is to secure the country against climate change, to protect against the effects of floods and droughts and to increase the water retention potential. It is a project co-financed by the International Bank for Reconstruction and Development (World Bank), the Council of Europe Development Bank, as well as with the support of funds from the Cohesion Fund under the Operational Programme Infrastructure and Environment 2014-2022 and the state budget. It is also planned to prepare a follow-up project in cooperation with the World Bank and the Council of Europe Development Bank.

Measures are planned for the restoration of watercourses, the reduction of the effects of floods and droughts, and the development and updating of documents on water management, flood risk management or the protection of water resources, which can be funded under the European Funds for Infrastructure, Climate, Environment 2021-2027 Programme.

Actions have also been planned in the field of building climate modelling competence with particular focus on the effects of climate change on Poland (strategic objective included in the Strategy of the Institute of Meteorology and Water Management - National Research Institute for the years 2021-2025), as well as development of High Impact Weather forecast offer - assessing and specialising - for the area of Poland with high variability and microclimatic diversity, which require handling other spatial data.

4.2.3. Agriculture

The adaptation of agriculture to climate change is set out in strategic and policy documents, the primary one being the 'Strategy for Sustainable Rural, Agricultural and Fisheries Development 2030'. This strategy was updated in 2023 in response to changes in the external environment and to strengthen public action in the area of ensuring food security and increasing the resilience of the agri-food sector to crises. The need to build greater resilience to climate change and to strengthen sustainable food security capacity is clearly highlighted in the Strategy.

Building agriculture's resilience to climate change focuses on comprehensive water management measures in relation to observed and projected water shortages. State action consists of supporting the transformation of the sector towards sustainable agriculture.

The approach to adaptation of agriculture to climate change is based on the use of synergies of actions that usually serve multiple objectives, such as adaptation, climate protection, soil and water conservation, and biodiversity protection, for example.

In the context of adapting agriculture to climate change, the most important measures are those taken to use water efficiently by reducing water losses, improving irrigation practices, water recovery and water storage by equipping farms with rainwater and snowmelt harvesting tanks. Good agricultural practices related to water resources management, such as pond preservation and water retention in permanent grasslands, among others, will also be important.

Table 89. Adaptation of agriculture to climate change

Plans and programmes implemented	Implemented actions
Rural Development Programme 2014-2020 and the continued implementation of the Common Agricultural Policy 2023-2027	– Afforestation of agricultural land (since 2004, about 80,000 ha of agricultural land unsuitable for agricultural production have been afforested); – Support for investments increasing the resilience of forest ecosystems and their environmental value (from 2019); – Support for the establishment of mid-field afforestation (from 2022); – Support for the establishment of agroforestry schemes (from 2023); – Support for investments related to development, modernisation and adjustment of agriculture and forestry within the framework of water resources management (cooperation with the State Water Holding 'Polish Waters' and municipalities); – Agri-environment and agri-environment-climate measures, including payments to compensate for additional costs incurred and income foregone by farmers who voluntarily apply production methods favouring the preservation of biodiversity, landscape and environmental resources, primarily soil and water (promotion of sustainable agriculture, soil and water protection, preservation of orchards of traditional fruit tree varieties, protection of Natura 2000 areas and biodiversity on arable land, preservation of endangered plant and animal genetic resources in agriculture). Approximately 798,000 ha were supported under the RDP 2014–2020, 158,000 ha under the CAP Priority Programme; – Investments contributing to the protection of the environment and the climate (watering holes for animals, installations to improve ventilation or lower the temperature in livestock buildings, hail nets, decision support systems); – On-farm investments in RES and energy efficiency improvements; – Intervention in the fruit and vegetable sector, including systems to improve water management.
Strategic Plan for the Common Agricultural Policy 2023-2027 (new elements)	– Implementation of conditions linked to good agricultural culture standards; – Implementation of ecoschemes: • carbon farming and nutrient management, • water retention on permanent grassland, • land taken out of production, including land taken out of production involving established landscape features. – Interventions related to reforestation and afforestation of agricultural land.

Source: study by the IEP-NRI

In addition, the Ministry of Agriculture and Rural Development is implementing the *'Programme of measures to reduce water pollution by nitrates from agricultural sources and to prevent further pollution'*¹²², which supports adaptation to climate change not only for agriculture, but also for aquatic and water-dependent ecosystems.

4.2.4. Biodiversity

Adaptation to climate change in the area of biodiversity protection is supported by increasing efforts to protect nature and create a coherent system of protected areas in Poland. Actions in this respect have their basis in the '2030 National Environmental Policy', in which the direction of action 'Management of natural and cultural heritage resources, including protection and improvement of the state biodiversity and landscape' was indicated. Within the framework of this direction, conservation task plans for Natura 2000 sites are developed, implemented and updated. Climate change appears as one of the threats to the objects of protection of Natura 2000 sites, the status of which is reported every 6 years to the European Commission. Long-term droughts and desertification threaten water-dependent ecosystems: rivers, lakes, wet meadows and swampy forests and peatlands. Lack of rainfall also increases the risk of fires in forest ecosystems, meadows, degraded peatlands. Heavy rains and violent thunderstorms pose a danger to forest ecosystems. Climate change is also linked to the spread of invasive alien species, which cause damage to ecosystems where they have no natural enemies.

Poland does not have an up-to-date *'The programme of conservation and sustainable use of biodiversity along with Action Plan 2030'*, fulfilling the obligations of the Convention on Biological Diversity.

The General Directorate for Environmental Protection which is responsible for the protection of biodiversity in Poland, has prepared a draft government document entitled 'Wetlands Protection Strategy for 2025-2035'. This strategy envisages a number of legal, administrative and financial measures related to the protection of wetlands. In the context of adaptation to climate change, it is planned e.g., to introduce restrictions on the licensing of peat extraction, to establish a certification body for horticultural products substituting for peat and to increase fees for the marketing of domestic and imported peat.

Strategic biodiversity conservation projects are also being prepared for implementation under the European Funds for Infrastructure, Climate, Environment 2021-2027 Programme concerning the updating of conservation task plans for Natura 2000 sites together with monitoring and the implementation of active conservation measures in Natura 2000 sites.

Climate change is intensifying the spread of alien species. In 2022, the government adopted the 'Action Plan on Priority Pathways for the Translocation of Invasive Alien Species'¹²³. The overarching goal of the plan is to improve the status of biodiversity by preventing, minimising and mitigating adverse impacts on biodiversity, the unintended introduction and spread of invasive alien species. The plan will be implemented between 2024 and 2029 with the support of European funds.

¹²² <https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20230000244>

¹²³ <https://monitorpolski.gov.pl/MP/2022/706>

4.2.5. Forests

One of the adaptation actions for forestry identified in the *Strategic adaptation plan for sectors and areas vulnerable to climate change by 2020 with the prospects until 2030* is the development of programmes for forestry adaptation to climate change. The State Forests National Forest Holding has developed a 'Comprehensive programme to prevent forest dieback processes in Poland and mitigation actions until 2030'¹²⁴. The aim of the programme is to prevent or minimise the negative effects of rapid climate change, including, above all, the prevention of large-scale forest dieback. The programme focuses on ensuring that Polish forests will fulfil (now and in the future) all important ecosystem services, including economic, social and ecological ones.

The programme implements the provisions of the development strategy - EPP 2030, which sets out measures to support multifunctional and sustainable forest management and the adaptation of forestry to climate change, including consideration of forest disaster risk management.

The programme was developed following an in-depth analysis of the effects of climate change on forests, the causes and magnitude of forest dieback in Poland between 2015 and 2021 and taking into account projected climate change. A strategic environmental assessment and public consultation of the document was carried out and it was adopted for implementation in 2023.

Adaptation policies in forests are focused on increasing retention, preventing erosion and countering the effects of extreme events – drought-related fires and the effects of strong winds - as well as protecting biodiversity. In 2023, major projects implemented by the Coordination Centre for Environmental Projects in cooperation with forest districts under the OPI&E 2014-2020 *Measure 2.1 Adaptation to climate change with safeguards and increased resilience to natural disasters, in particular natural disasters, and environmental monitoring* have been completed.

Table 90. Adaptation to climate change in forests

Area of adaptation measures	Implemented projects
Small-scale retention and combating water erosion	Comprehensive project on adaptation of forests and forestry to climate change – small-scale retention and prevention of water erosion in lowland areas https://www.ckps.lasy.gov.pl/adaptacja-na-terenach-nizinnych Comprehensive project on adaptation of forests and forestry to climate change – small retention and prevention of water erosion in mountainous areas https://www.ckps.lasy.gov.pl/adaptacja-na-terenach-gorskich
Forest fires	Comprehensive project on adaptation of forests and forestry to climate change – preventing, counteracting and mitigating the effects related to forest fire threats https://www.ckps.lasy.gov.pl/ochrona-przeciwpozarowa
Biodiversity conservation	Comprehensive species and habitat conservation project on State Forests National Forest Holding managed areas https://www.ckps.lasy.gov.pl/ochrona-gatunkow-i-siedlisk

Source: study by the IEP-NRI

¹²⁴ https://www.ckps.lasy.gov.pl/aktualnosci/-/asset_publisher/HTXX9aadIRBB/content/decyzja-nr-201-dyrektora-generalnego-lasow-panstwowych



Fig. 76.

Comprehensive project on adaptation of forests and forestry to climate change – small retention and prevention of water erosion in mountainous areas. Nowy Targ Forest District. 'Bór na Czerwonym' nature reserve, Ramsar site

Photo: M. Hajto

4.5.6. Baltic coastal zone

Adaptation to climate change in the coastal area is included in the 'Maritime Policy of the Republic of Poland until 2020 (with an outlook until 2030)'¹²⁵. This policy is consistent with the Integrated Maritime Policy of the European Union¹²⁶, which covers all areas of political, economic, social, scientific and cultural life that are in any way related to the sea and its resources.

The improvement of the marine environment and the protection of the seashore is one of the areas of this policy. To ensure the protection of seashores and estuarine sections of coastal rivers against erosion phenomena, the following measures are under implementation:

- strengthening and maintaining the flood protection system of coastal areas,
- stabilisation of the coastline, prevention of erosion and disappearance of beaches and degradation of cliffs,
- continuation and development of permanent monitoring of the state of the sea shores and the coastal water zone.

These measures are implemented under the multi-annual 'Programme for the Protection of the Seashore'¹²⁷, adopted in 2016.

Adaptation to climate change as part of maritime policy is implemented by the Maritime Offices in Gdynia and Szczecin. Under OPI&E 2014-2020, a number of projects have been implemented to protect the seashore and to adapt to climate change. Among such projects, flood hazard maps and seaward flood risk maps have been reviewed and updated, and draft spatial management plans for Polish maritime areas have been developed, as well as detailed plans for specific parts of the coast.

Since 2021, the 'Spatial Development Plan for the Internal Sea, Territorial Sea and Exclusive Economic Zone at a scale of 1:200 000'¹²⁸ is in force, in which specific resolutions have been prepared considering the objectives of sustainable development, including building resilience to climate change.

¹²⁵ <https://www.gov.pl/web/infrastruktura/zintegrowana-polityka-morska-unii-europejskiej79>

¹²⁶ <https://www.gov.pl/web/gospodarkamorska/zintegrowana-polityka-morska-unii-europejskiej>

¹²⁷ <https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20160000678>

¹²⁸ <https://dziennikustaw.gov.pl/DU/2021/935>



Fig. 77.

Coastal protection of the Hel Peninsula area (2017—2022)¹²⁹.

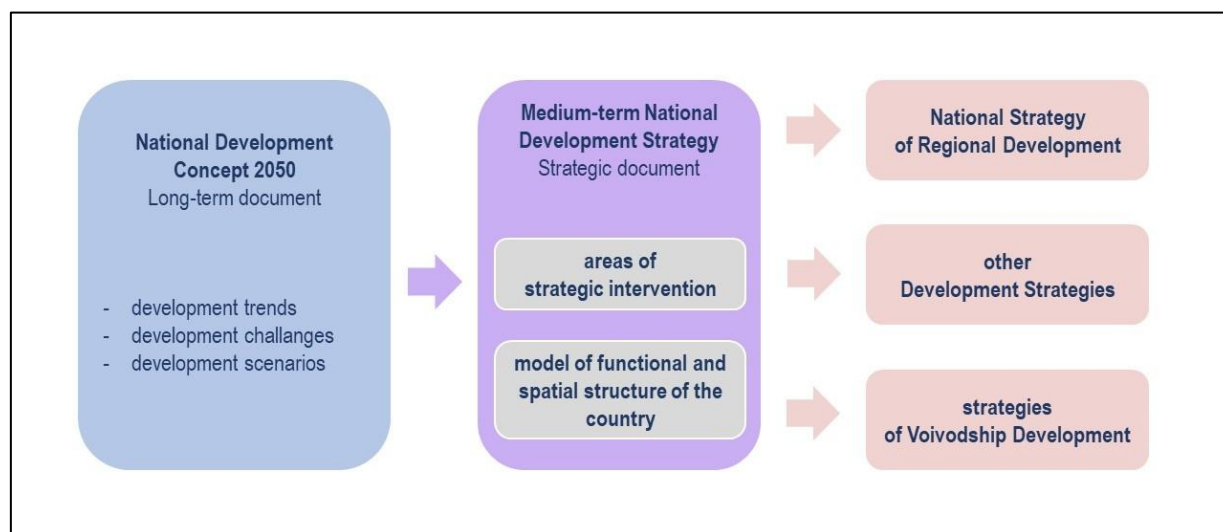
Photo: M. Hajto

4.3. Integrating climate change issues with national policies and strategies

4.3.1. Development policy framework

The legal basis for conducting development policy in Poland is the Act on the Principles of Conducting Development Policy¹³⁰. By updating the Act in 2020, changes were introduced to build an integrated development management system, especially with regard to the integration of the socio-economic programming system and spatial planning at all levels. Currently, the elements of the Polish development management system are the national development concept, the medium-term national development strategy, strategies and public policies and development programmes.

Fig. 78. Management system for the development of Poland



Source: Ministry of Development Funds and Regional Policy

The country's development policy is coordinated by the Development Policy Coordination Council. It is responsible for the broad, comprehensive management of national development. It is also an important tool for coordinating the work of ministries in the field of national development programming. Representatives of ministries and regions as well as external experts take part in the

¹²⁹ https://www.umgdy.gov.pl/fundusz_europejski/ochrona-brzegow-morskich-w-rejonie-polwyspu-helskiego/

¹³⁰ Act of 6 December 2006 on the Principles of Conducting Development Policy (Journal of Laws of 2024, item 324, as amended) <https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20240000324>

work of the Committee. Individual ministries supervise and support the activities of research institutes whose task is, inter alia, to provide knowledge for shaping development policy.

As of 2022, work is underway to identify a mechanism for coordination, reporting and evaluation of adaptation policy. Developing a national integrated approach for integrating climate change adaptation into the development management system is one of the priorities of the Government of the Republic of Poland on climate change adaptation. In this approach, the new national adaptation strategy should be considered as one of the key state development strategies anchored in the medium-term national development strategy.

As part of the strategic environmental assessment, a public consultation is held in which every citizen has the opportunity to submit proposals and comments on the strategy and the Environmental Impact Assessment.

4.3.2. National Development Concept 2050 (draft)

The National Development Concept 2050, a draft of which has been prepared at the Ministry of Development Funds and Regional Policy, is planned to be adopted by the Council of Ministers by the end of 2024. Climate change and adaptation to the effects of climate change have been included in the Concept as key issues for national development. The environment and climate protection is one of the most important issues in this document.

The concept outlines development trends, long-term challenges, alternative development scenarios and conclusions. The National Development Concept 2050 has an umbrella character for other strategies and provides a framework for the development of a new medium-term national development strategy. It is also intended to highlight long-term challenges – including those relating to the environment and climate, which require strategic decisions to be taken and actions to be implemented today.

One of the five identified trends of relevance in the long term is 'Increasing dynamics of environmental and climate change'. This trend takes into account the progressive transformation of the climate system, increasing degradation of the natural environment, decline in biodiversity, unsustainable use of raw materials and waste management. The results of the analysis of environmental and socio-economic trends were the basis for the in-depth integration of climate change into the elaborated challenges for Poland's development until 2050. The challenges indicate the priorities for development in the long-term perspective in terms of climate protection and adaptation. These are: energy transition, protection of natural capital and economics of moderation, resilience of the state to the threats of climate change and food security.

Work on The National Development Concept 2050 was conducted on the basis of scientific research and using foresight methods¹³¹. Stakeholders (representatives of regional self-governments, academia, NGOs, business and students) were consistently involved in developing scenarios for the country's development and development challenges.

¹³¹ The work was conducted under the project 'Operationalisation of the Development Management System of Poland. Improving and Introducing Innovative and Effective Solutions to the Socio-Economic and Spatial System in Long-Term Development Policy Programming' carried out by the Institute of Urban and Regional Development, Institute of Environmental Protection - National Research Institute and the Ministry of Development Funds and Regional Policy, funded by the National Strategic Research and Development Programme (GOSPOSTRATEG-III/0032/2020).

4.3.3. Medium-term national development strategy

The role of the country's medium-term development strategy is fulfilled by the '*Strategy for Responsible Development for the period up to 2020 (including the perspective up to 2030)*'¹³². Issues related to climate change adaptation and disaster risk management are included in this strategy, placing particular emphasis on energy security under climate change conditions, adaptation of agriculture in relation to the impact of climate change on available water resources, a comprehensive programme for the adaptation of forests and forestry to climate change, the development of BGI in urban areas.

The new challenges and recommendations arising from the National Development Concept 2050, the reorientation of development policy priorities in relation to the socio-economic and geopolitical situation and the new directions of EU development were the rationale for initiating the process of preparing a draft of a new medium-term national development strategy. The new strategy will have to respond, inter alia, to challenges arising from climate change and related socio-economic challenges, energy and technological transformation. The initial assumptions identify climate change adaptation issues as an important direction of intervention.

4.3.4. Development strategies

Climate change issues are integrated into the country's development strategies¹³³. Climate change is included in the diagnosis as a significant threat to development in specific sectors. Climate protection and adaptation to climate change are identified as a challenge that the country needs to address. The most important national strategies in which climate change adaptation plays a key role are the '*2030 National Environmental Policy – Development Strategy for Environment and Water Management*' and the '*Strategy for Sustainable Rural, Agricultural and Fisheries Development 2030*'. Both documents include climate change adaptation as an essential area of intervention that will contribute to environmental and food security.

Table 91. Integration of climate change issues into Poland's development strategies

Development strategies	Objectives and directions for action related to adaptation to climate change and leading to additional benefits in climate change mitigation
2030 National Environmental Policy – Development Strategy for Environment and Water Management Ministry of Climate and Environment https://www.gov.pl/web/ia/polityka-ekologiczna-panstwa-2030-pep2030	– Adaptation to climate change and disaster risk management; – Sustainable water management, including ensuring access to clean water for society and the economy and achieving good water status; – Management of natural and cultural heritage resources, including protection and improvement of biodiversity and landscape; – Support for multifunctional and sustainable forest management; – Waste management towards a circular economy, combating climate change; – Environmental education, including the development of sustainable consumption patterns; – Improvement of the environmental control and management system and improvement of the financing system.
National Strategy for Regional Development 2020 Ministry of Development Funds and Regional Policy https://www.gov.pl/web/fundusze-regiony/krajowa-strategia-rozwoju-regionalnego	– Increasing the use of potential; – Addressing crises in degraded areas; – Developing infrastructure to support the provision of public services and increase the investment attractiveness of areas; – Innovative development of the region and improvement of the Regional Intelligent Specialisations approach; – Supporting entrepreneurship at regional and local level; – Improving the organisation of public service provision.

¹³² <https://www.gov.pl/web/fundusze-regiony/informacje-o-strategii-na-rzecz-odpowiedzialnego-rozwoju>

¹³³ <https://www.gov.pl/web/ia/strategie-krajowe>

Development strategies	Objectives and directions for action related to adaptation to climate change and leading to additional benefits in climate change mitigation
Strategy for Sustainable Transport Development 2030 Ministry of Infrastructure https://www.gov.pl/web/infrastruktural/projekt-strategii-zrownowazonego-rozwoju-transportu-do-2030-roku2	– Building an integrated and interconnected transport network for a competitive economy – Improving the organisation and management of the transport system – Changing individual and collective mobility (including promotion of public transport) – Reducing the negative impact of transport on the environment
Strategy for Sustainable Rural, Agricultural and Fisheries Development 2030 Ministry of Agriculture and Rural Development	– Increasing the profitability of agricultural and fisheries production and agri-food processing; – Building resilience in agricultural and fisheries production; – Ensuring national food security and food quality including climate change resilience; – Energy transformation of the agri-food sector and development of the bio-economy; – Preparing the Polish agri-food sector for EU enlargement and new foreign trade conditions; – Sustainable revitalisation of villages and small towns; – Sustainable management and protection of environmental resources; – Climate change adaptation and mitigation; – Building and developing capacity for social and territorial cooperation; – Developing the economy and social solidarity of rural areas.
Energy Policy of Poland until 2040 Ministry of Climate and Environment https://www.gov.pl/web/ia/polityka-energetyczna-polski-do-2040-r-pep2040	– Expanding electricity generation and network infrastructure; – Developing energy markets; – Developing renewable energy sources; – Developing district heating and cogeneration; – Improving energy efficiency
2030 Social Capital Development Strategy (Cooperation, Culture, Creativity) https://www.gov.pl/web/ia/strategia-rozwoju-kapitalu-spoelnego-2030-srks	– Improving support and cooperation mechanisms between public institutions and citizens; – Developing and strengthening organised forms of civic activity; – Digitisation, digital restoration and accessibility of cultural assets; – Increasing the contribution of creative sectors to the economic development of the country; – Strengthening the creative potential of society.

Source: study by the IEP-NRI

The objectives and direction of actions set in the strategies are implemented through strategic projects financed from the state budget and EU funds. In 2022-2023, projects from the 2014-2020 EU financial perspective were continued and completed, and projects are being prepared for financing in 2021-2027. The National Recovery and Resilience Plan also implements the goals and directions of the country's adaptation policy.

Poland has implemented requirements¹³⁴ for the funding of projects from EU funds. These projects should be verified in terms of impact on climate and adaptation to climate change (climate resilience). This serves to establish their compliance with climate change mitigation objectives (reducing GHG emissions and increasing carbon sequestration) and adaptation to a changed and changing climate. The National Recovery and Resilience Plan has been analysed to meet the principle of 'do no significant harm' to the environment.¹³⁵

¹³⁴ Regulation (EU) 2021/1060 of the European Parliament and of the Council of 24 June 2021 laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, the Just Transition Fund and the European Maritime, Fisheries and Aquaculture Fund and financial rules for those and for the Asylum, Migration and Integration Fund, the Internal Security Fund and the Instrument for Financial Support for Border Management and Visa Policy

¹³⁵ Regulation (EU) 2021/241 of the European Parliament and of the Council of 12 February 2021 establishing the Recovery and Resilience Facility.

4.4. The ecosystem approach in adaptation policy

The ecosystem approach is mainstreamed into adaptation policy in Poland. Policy and financial instruments for nature-based solutions are in place and legal instruments are planned for implementation.

In the National Development Concept 2050, an 'umbrella' document for other strategies and public policies, climate change adaptation is based on natural resources. It focuses on restoring ecosystems and improving ecosystem services to protect society from the negative impacts of climate change. The role of blue-green infrastructure as a critical and fundamental resource for biodiversity restoration and the need for its sustainable use is emphasised. The recognition of BGI as a critical resource in the legal system is indicated as crucial.

Blue-green infrastructure is promoted in national development strategies (Table 92).

Table 92. Ecosystem approach in country development strategies

Country development strategies	Integrating the ecosystem approach into the objectives and action directions of the strategies
Strategy for Responsible Development for the period up to 2020 (including the perspective up to 2030) https://www.gov.pl/web/fundusze-regiony/informacje-o-strategii-na-rzecz-odpowiedzialnego-rozwoju	- managing rainwater in urban areas through various forms of retention and the development of green infrastructure; - increasing the emphasis on enhancing the share of natural CO₂ removal through the growth of permanent biologically active areas such as forests and urban greenery.
2030 National Environmental Policy – Development Strategy for Environment and Water Management Ministry of Climate and Environment https://www.gov.pl/web/ia/polityka-ekologiczna-panstwa-2030-pep2030	- developing the blue-green infrastructure of urbanised areas in order to maintain spatial connectivity within these areas and with open spaces and to support climate change adaptation processes; - measures for the renaturalisation of rivers and their valleys, wetlands, selected parts of the coastline; - mapping and valuing ecosystem services.
National Strategy for Regional Development 2020 Ministry of Development Funds and Regional Policy https://www.gov.pl/web/fundusze-regiony/krajowa-strategia-rozwoju-regionalnego	- recognising natural resources as a potential factor in the development of the region, based on ecosystem services and implemented in a sustainable manner, taking into account the needs of future generations; - protecting and developing green spaces in urban areas to solve urban problems and improve the quality of urban spaces.
Strategy for Sustainable Transport Development 2030, Ministry of Infrastructure https://www.gov.pl/web/infrastruktura/projekt-strategii-zrownowazonego-rozwoju-transportu-do-2030-roku2	promoting the creation of green traffic routes, including streets and tracks, by increasing the amount of biologically active area, reducing the negative impact of transport on the environment and hygienic conditions in urban areas.
Strategy for Sustainable Rural, Agricultural and Fisheries Development 2030 Ministry of Agriculture and Rural Development	- managing rainwater in urban areas through various forms of retention and the development of green infrastructure; - maintaining and, as land becomes available for afforestation, increasing the overall forest ratio of the country and the compactness of forest complexes and afforested areas; - optimising support to farmers to deal with the effects of drought; - introducing comprehensive risk management solutions for farms and the agri-food sector; - disseminating agricultural practices in favour of the environment, climate and animal welfare using CAP instruments; - increasing water retention, including by e.g., irrigation and run-off reduction; - preventing flooding and flash floods of land used for agricultural production; - counteracting the decline in production profitability due to the reduction of greenhouse gas emissions from agriculture, fisheries and the agri-food chain; - investing in irrigation of agricultural land; - developing and implementing ad hoc aid schemes for farms affected by adverse weather conditions or exceptional circumstances that prevent or hamper agricultural and fishing activities.

Source: study by IEP-NRI

The ecosystem approach is promoted in particular in urban areas. In the *Strategic adaptation plan for sectors and areas vulnerable to climate change by 2020 with the prospects until 2030*, the direction of action includes the need to increase green and water areas in urban development plans. The fundamental importance of greenery in cities is given by NUP 2030, assuming that one of the principles for conducting urban policy is to take care of the greening of urban areas. 'This principle concerns not only the appropriate management of blue-green infrastructure, but also involves the promotion of pro-environmental social attitudes. Each investment or package of projects in a given urban area should be analysed from the point of view of protecting the natural environment and increasing the biologically active area with greenery providing shade and high greenery, which has a positive impact on the perception of temperature extremes by city residents. In addition, nature-based solutions that are technologically feasible, such as green roofs or facades and various forms of water retention, should be taken into account.'¹³⁶ One of the activities of NUP 2030 is the legal empowerment of BGI. The idea is to recognise it as critical infrastructure, pursuant to the Act on Crisis Management¹³⁷.

In addition to promoting the ecosystem approach in climate change adaptation in policies, BGI is included in financial instruments. The European Funds for Infrastructure, Climate and Environment 2021-2027 Programme allocates EUR 2.79 billion for climate change adaptation and nature conservation projects. The fund mainly finances projects that take into account the priority of nature-based solutions over technical solutions.

A number of initiatives are being undertaken to use ecosystems in climate change adaptation. Noteworthy is the 'No more concrete in city centres' initiative, which has been running since 2021 and in which the Ministry of Climate and Environment is cooperating with the Ministry of Development Funds and Regional Policy and the Ministry of Culture and National Heritage. The aim of such operation is reducing the urban heat island phenomenon, increasing the level of micro and small-scale retention and green space in cities - by creating financial and legal solutions to support the adaptation of cities to climate change.

4.5. Stakeholder involvement in adaptation policy

Adaptation policy is shaped and implemented with the participation of stakeholders. Stakeholder participation and implementation involves all levels of governance – national, regional and local – and a variety of actors – public administration, community organisations, academia, private sector.

The Ministry of Climate and Environment, which is responsible for adaptation policy in Poland, is working with other ministries to ensure consistency between sectoral policies and adaptation policy. As part of the process of preparing the framework for the new National Climate Change Adaptation Strategy, a 'Strategy and Plan for Stakeholder Involvement' was developed as a basis for involving the public in the development of adaptation policy.

Developing the National Development Concept 2050 was done in a participatory manner, with strong involvement of the scientific community and regional governments, thanks to which e.g., the issues of

¹³⁶ <https://www.gov.pl/web/fundusze-regiony/polityka-miejska>

¹³⁷ Journal of Laws of 2022, item 261, as amended. Critical infrastructure are systems and their constituent functionally related facilities, including buildings, equipment, installations, services that are key to the security of the state and its citizens and that serve to ensure the smooth functioning of public administration, as well as institutions and entrepreneurs.

climate change and adaptation to the effects of these changes have been strongly emphasised in the draft document.

The Ministry of Climate and Environment runs a project called 'Partnership: Environment for Development' network. Within its framework, intersectoral groups are created and operate, bringing together representatives of government and local administration as well as the scientific, expert and non-governmental communities. The teams deal with environmental and climate issues - one of them directly with climate change adaptation. Its activity is a pretext for the creation of a formal management system for adaptation policy in the future.

The 'No more concrete in city centres' initiative is a forum for involving various stakeholders in climate change adaptation in cities.

Since 2023, the Committee on the Climate Crisis of the Polish Academy of Sciences is active¹³⁸. The Committee's task is to inform the public and the authorities about the threat of climate change and to propose solutions to limiting and adapt to it. The Committee continues the work of the Climate Crisis Advisory Panel, which published eight science-based alarmist communications on various climate change and adaptation issues between 2020 and 2022.

The third sector is also involved in adaptation efforts, represented by e.g., the Climate Coalition¹³⁹, which is an agreement of 27 NGOs involved in climate protection activities, and the non-profit Health and Environment Alliance¹⁴⁰, which analyses the impact of climate on public health. NGOs and scientific institutions (20 entities) participate in the Climate Knowledge Base initiative¹⁴¹, which aims to counteract misinformation by making available reports, studies and research results published by credible sources and translating scientific knowledge into accessible language.

Cooperation with the third sector is supported by the government under the Government's Civic Initiatives Fund Programme. Initiatives related to climate change adaptation and sustainable development can receive support under the strategic area 'Ecology'.

There is a Youth Climate Council at the Ministry of Climate and Environment, which is an advisory and consultative body. It also provides a platform for discussion, exchange of experiences, postulates and ideas among young people from all over Poland.

Enterprises, including SOEs and municipal companies, recognise the impacts of climate change and integrate climate change issues into their operations. Implemented legislation on corporate sustainability reporting¹⁴² engages business in climate action and adaptation.

In a particular way, urban enterprises are involved in local adaptation policies and measures. Enterprises (both municipal and private) active in the area of stormwater management carry out adaptation tasks on their own or in cooperation with local authorities to counter sudden flooding (e.g., 'Gdańskie Wody'¹⁴³). In addition, entrepreneurs implement BGI projects around their own facilities.

¹³⁸ <https://klimat.pan.pl/>

¹³⁹ <https://koalicjaklimatyczna.org/>

¹⁴⁰ <https://healpolska.pl/>

¹⁴¹ <https://klimatycznabazawiedzy.org/>

¹⁴² 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, as regards corporate sustainability reporting.

¹⁴³ <https://www.gdmel.pl/>

A tool for active community participation in climate change adaptation is civic budgets¹⁴⁴, allowing every resident to take the initiative, debate and co-determine the allocation of part of the public budget. By 2022, 320 municipalities (i.e. 12.9% of all municipalities in Poland) have set aside an amount for a civic budget in the municipal budget. In municipalities with more than 50 000 inhabitants, 85.6% of municipalities had a civic budget. In 2022, the civic budget in municipalities in Poland amounted to PLN 650.7 million, an amount that has been successively increasing in recent years. The amount increased by PLN 59.4 million compared to 2021 and by PLN 29.9 million to 2020¹⁴⁵. Some local authorities set the part of the civic budget that must be allocated to greening public spaces and other environmental protection measures.

¹⁴⁴ Act of 8 March 1990 on municipal self-government (Journal of Laws of 2024, item 609, as amended).

¹⁴⁵ <https://stat.gov.pl/obszary-tematyczne/rachunki-narodowe/statystyka-sektora-instytucji-rzadowych-i-samorzadowych/wspoldzialanie-jednostek-samorzadu-terytorialnego-z-mieszkancami-w-2022-roku,11,1.html>

5. Progress on implementation of adaptation

The regional and local specificity of climate change adaptation determines the choice of appropriate actions to support increased resilience of local communities most vulnerable to climate change or areas or sectors particularly threatened by extreme climate events. A few selected examples of activities in Poland show the diversity of the adaptation process, which involves different actors, both government agencies and local authorities, NGOs and local residents, as well as various funds.

5.1. Work on the new National Strategy for Adaptation to Climate Change

In 2022, the Ministry of Climate and Environment, which is responsible for the National Adaptation Strategy, obtained support from the European Commission's Technical Support Instrument for the implementation of the project 'Strengthening coordination of climate change adaptation policies between local, regional and national authorities'. As part of the project, a review of the existing document and the way it was implemented was carried out (cf. Chapter IV.6.2.), and recommendations were prepared regarding the content and way of working on the new National Adaptation Strategy, Plan of Action and Roadmap 2050, including the building of cooperation and coordination mechanisms by various actors.

For the new adaptation policy, an analysis of extreme events and their impacts, a regional and sectoral climate risk analysis based on new climate change scenarios will be carried out. Climate change adaptation measures will be developed for selected sectors and the costs of adaptation measures will be assessed.

The results of the analyses of climate change impacts and climate risk and the recommendations for the coordination of adaptation policy will be the basis for the definition of Poland's new climate change adaptation goals. These goals will be developed in a participatory manner by involving stakeholders. The draft National Adaptation Strategy will undergo the necessary consensus and strategic environmental assessment. It is assumed that the Strategy will be adopted by 2027 at the latest.

The development and adoption of a new National Adaptation Strategy together with the Action Plan and the development of a coordination, reporting and evaluation mechanism for adaptation policy is a priority for the Government of the Republic of Poland in the field of adaptation to climate change. Previous experience and observations on the effects of climate change indicate the need to give the National Adaptation Strategy a higher profile in the state governance system than it has had so far. It is necessary to strengthen the importance of climate change adaptation in the system of making and conducting public policies - as one of the potential so-called 'driving forces' of systemic change.

5.2. Measures related to the implementation of blue-green infrastructure

Introducing and enhancing blue-green infrastructure has become a significant direction of many urban adaptation strategies to the effects of climate change. Depending on local circumstances, approaches vary in scale from solutions such as green roofs and walls, rain gardens, green streets, green tracks, green bus stops, green playgrounds, school grounds, green car parks, pocket parks and flower meadows, to larger-scale measures involving the transformation of industrial areas into climate-resilient neighbourhoods.

Gdańsk is the first city in Poland to have ground-based rain gardens - nine pilot rain gardens have been implemented by the 'Gdańskie Wody' company since 2018¹⁴⁶. Each is an individual project but has the same function – to collect and use rainwater from nearby land and paved surfaces. The aim is to ensure that at least 30 mm of rainfall is absorbed, lasting about half an hour. Rainfall that does not fit in the garden, does not have time to evaporate, soak into the soil or be absorbed by plants, is discharged into the rainwater system as so-called 'excess rainfall'.



Fig. 79.

The rain garden in Gdańsk at the intersection of 3 Maja Street and Armii Krajowej Avenue is a system of interconnected dry gardens consisting of three cascading basins. The garden collects water that the rainwater drainage system is unable to accommodate during heavy rains. The area of the garden is 758.7 m², with a capacity of 98.2 m³.

Photo: M. Hajto

The oldest (model) garden by the flood storage facility of 'Gdańskie Wody' in Stogi, Kaczeńce Street (area 449 m², retention capacity 33.49 m³) stores water used for watering other plants. Another example is the mini-park at the junction of Radiowa and Radarowa streets in Matarnia (area 739.77 m², retention capacity 343.9 m³). It was created as a natural drainage for streets where water collected during heavy rainfall. The total surface area of the small retention facilities is nearly 20 ha, capable of absorbing nearly 1,500 m³.

The creation of small, friendly green areas in the city to serve the residents of Kraków for relaxation and contact with nature is the aim of the Gardens of Cracovians project¹⁴⁷ implemented by the Board of Urban Greenery. Pocket parks, so called because of their small size, usually not exceeding 5000 m², are being created in the city. Often located in densely built-up areas, they are peculiar enclaves of greenery with a unique character defined by a variety of themes. The intention is that, in these places, residents should be able to feel like they are in their own garden and that every resident in the immediate vicinity should have access to a landscaped green area within a 5- to 15-minute walk from their place of residence. Twenty-five pocket parks have been created in the Krakow area, with a target of 70 by 2030. It is estimated that more than 54000 people live within a 500 m radius of pocket parks.

¹⁴⁶ Institute of Environmental Protection 2023. Dynakowska M. et al. Catalogue of good adaptation practices; <https://klimada2.ios.gov.pl/files/2024/Katalog%20dobrych%20praktyk%20adaptacyjnych.pdf>

¹⁴⁷ Ibidem.

The garden on the roof of the University of Warsaw Library¹⁴⁸ is the first such large green roof in intensive cultivation in Poland. It has been designed as a 'building-environment' system. It consists of an upper part (area of 10 000 m²) and a lower part (area of 15 000 m²) connected by a stream with cascading water. In addition to the greenery (area 2 000 m²), the roof area includes technical facilities and a glass roof over the reading room. The green roof of the University of Warsaw Library serves various environmental, economic and social functions such as an increase in the area of green space within the city, improved rainwater management, acoustic insulation of the library building, shelter for animals (including birds) and a place for residents and tourists to rest and participate in various cultural events (concerts, art exhibitions). The measurable effect is a reduction of up to 30% in energy demand for air conditioning and heating the building.

The greening of tracks is a solution that is increasingly being introduced in the modernisation of tracks and the construction of new ones (Warsaw, Kraków). The total length of green tracks in the selected cities is: Kraków 28 km; Łódź 22.5 km; Warsaw 16 km¹⁴⁹.

5.3. Sustainable management of rainwater

An example of a comprehensive approach to the problem of rainwater management throughout the city, taking into account climate change in the 2050 perspective, is the project 'Construction and reconstruction of the rainwater drainage system and adaptation of the rainwater drainage system to climate change in the area of the city of Bydgoszcz'¹⁵⁰. This is the first such large initiative in Poland with EU support, the aim of which is to adapt the rainwater sewerage system in the Bydgoszcz city area to the current and planned land use, to protect the city from the effects of heavy rains and large amounts of rainwater and snowmelt – minimising flooding of buildings and flooding of streets, enabling water retention and use in dry periods. As a result of the project implemented by the Municipal Waterworks and Sewerage System company, covering an area of 29.5 km², there has been obtained 14 km of new and the renovation of 90 km of rainwater drainage networks and the construction of a dispersed retention system (66 retention reservoirs, rainwater sub-treatment plants, green area irrigation systems). The rainwater management system allows 36,900 m³ of rainwater to be retained and used to irrigate green areas and, after treatment, to feed ponds to restore the original ecosystem.

5.4. Agroforestry

The combination of agricultural and forestry production enables more effective adaptation to climate change, influencing, among other things, the slowing down of water run-off, reducing soil erosion, increasing water availability or moderating air temperature. In Poland, this system was commonly used in the past in the form of tree plantings on baulks demarcating arable fields. The planting of strip plantings, which act as a windbreak, reduce wind erosion, counteract water erosion and protect the hilly terrain from surface run-off, has been carried out at the Kietrz Agricultural Combine for several decades. Windbreaks and other mid-field wooded areas are also home to numerous herbaceous plants and a refuge for many animals.

¹⁴⁸ Ibidem.

¹⁴⁹ Ibidem.

¹⁵⁰ Ibidem.

An example of an agroforestry project in Poland is the 'Innovative model of cultivation, processing and distribution of herbs in the Zielawa valley'¹⁵¹. The aim of the project is to develop and implement a new model of alley-row co-cultivation of elderberry and fruit rose (wrinkled and wild) with shade-loving wild plants that are threatened and/or protected species, i.e. spotted myrtle, cloudberry and forest fern, as well as the introduction of wild plants e.g., common nettle, into cultivation. In addition, the intention was to develop and implement new products, namely dried fruit teas and spices, from species not previously used in such processing.

5.5. Restoration measures for rivers and their valleys

Treatments to restore the original water relations aim to improve the ecological status of rivers. The activities in the project '*Restoration of hydrological system in the Middle Basin of the Biebrza River Valley*'¹⁵², through gradual restoration of the natural water system, allowed to stop the degradation of peat soils restoring specific habitat conditions preferred by populations of breeding birds characteristic for open, flooded grasslands.



Fig. 80.

A bog in the Modzelówka area; photo by M. Siłakowski;

Source: <https://www.biebrza.org.pl/1036,galeria-fotografii>

The restoration of the natural hydrological regime as a result of the implementation

of the project '*Renaturalisation of the inland delta of the Nida River*'¹⁵³ has created conditions for the restoration of unique natural values within the middle Nida delta. The activities covered an area of 400 ha, on the territory of three municipalities: Kije, Pińczów and Imielno.

5.6. Development of small-scale retention and prevention of water erosion

Small retention activities have been carried out in the State Forests since the mid-1990s in line with the principles of sustainable forest management¹⁵⁴. The main objective of several large projects is the development of small retention, correcting inadequate long-term water management. Small retention reservoirs are being built, solutions are being used to slow down water run-off, and wetland habitats are being restored. The improvement of hydrological conditions has a positive impact on the state of ecosystems and therefore promotes the development of biodiversity. The measures carried out also contribute to drought resilience and a reduction in the threat of flooding.

'Comprehensive project for the adaptation of forests and forestry to climate change - small-scale retention and prevention of water erosion in lowland areas' is another activity undertaken by State

¹⁵¹ Ibidem.

¹⁵² <https://klimada2.ios.gov.pl/dobra-praktyka/renaturyzacja-sieci-hydrograficznej-w-basenie-srodkowym-doliny-biebrzy/>

¹⁵³ <https://klimada2.ios.gov.pl/renaturyzacja-rzek/renaturyzacja-srodladowej-doliny-rzeki-nidy/>

¹⁵⁴ Institute of Environmental Protection 2023. Dynakowska M. et al. Catalogue of good adaptation practices; <https://klimada2.ios.gov.pl/files/2024/Katalog%20dobrych%20praktyk%20adaptacyjnych.pdf>

Forests National Forest Holding, which aims to increase the resilience of forest areas to climate change. In the project, which was implemented between 2016 and 2023, activities were aimed at preventing or minimising the negative effects of natural phenomena, i.e.: the damaging effects of storm water, floods and flooding, drought and fires. The project mostly built small structures of simple construction using natural materials. As a direct result of the construction of 1,349 facilities damming water or slowing its flow, the volume of water retained has increased to 2.5 million m³ and the total retention capacity to nearly 4 million m³. The reservoirs created as part of the project not only contribute to improving the water balance and wetting of forest habitats but have also become an important refuge for aquatic wildlife, serve as watering holes for forest animals and act as biofilters.¹⁵⁵

Retention measures not only have the effect of locally reducing the threat of flooding, but also of minimising losses caused by water erosion and drought. This is particularly important in the mountains, where specific environmental conditions and climate change favour rapid rainfall and consequently sudden rivers and streams floods. The most important task of the 'Comprehensive project for the adaptation of forests and forestry to climate change – small-scale retention and the prevention of water erosion in mountainous areas'¹⁵⁶, was to store water not only in reservoirs, but also in wetlands



Fig. 81.

Nowy Targ Forest District – reservoir;

Source: <https://www.ckps.lasy.gov.pl/adaptacja-na-terenach-gorskich>

and in forest litter and soil. Foresters also carried out work to protect forest infrastructure from the effects of excessive water erosion. As a result of the project, the following indicators were achieved: volume of water retention: over 615 million m³, capacity of small retention facilities: over 916 million m³, 1099 facilities damming water or slowing its outflow.

5.7. Forest fire protection

The threat of forest fires in Poland is one of the highest in Europe. The frequency of fires is e.g., a consequence of climate change (prolonged droughts, low rainfall) or the species composition of forest stands (flammable essential oils characteristic of the predominantly coniferous species), but unfortunately most still occur through human fault (deliberate arson, grass burning or careless handling of fire). Between 2016 and 2023, the State Forests implemented the '*Comprehensive project for adapting forests and forestry to climate change – prevention, mitigation, and limitation of forest fire hazards*'¹⁵⁷, the aim of which was to reduce the negative effects caused by fires in forests and to efficiently locate the source of danger and minimise losses, and in the long term to reduce the average area of fires and to expand forest surveillance, especially in forest districts classified under the highest fire risk category. The implementation of tasks related to the development and modernisation of early

¹⁵⁵ <https://www.ckps.lasy.gov.pl/adaptacja-na-terenach-nizinnych>

¹⁵⁶ <https://www.ckps.lasy.gov.pl/adaptacja-na-terenach-gorskich>

¹⁵⁷ <https://www.ckps.lasy.gov.pl/ochrona-przeciwpozarowa>

warning and threat forecasting systems contributed, among other things, to an increase in forest areas covered by monitoring and shorten detection time of threats.

5.8. Biodiversity conservation and forest management in the context of climate change

To improve the conservation status of natural habitats and species of plants and animals occurring in Natura 2000 sites located on land managed by the State Forests, the '*Comprehensive project for the conservation of species and natural habitats in areas managed by the State Forests National Forest Holding*' was implemented¹⁵⁸. The scope of the project was to carry out activities – best practices in species and habitat conservation – in 117 Natura 2000 sites between 2017 and 2023, in accordance with the provisions of conservation task plans, protection plans, and forest management plans drawn up for Natura 2000 sites. As a result of the active conservation activities carried out, the conservation status of natural habitats improved: 14 893 hectares of habitat area supported in terms of gaining an improved conservation status, 30 habitat types of 32 species covered by conservation measures.



Fig. 82.

Szczecinek Forest District – swamp forest

Source: <https://www.ckps.lasy.gov.pl/ochrona-gatunkow-i-siedlisk>

5.9. Adapting the coastal zone to climate change

Adaptation measures for the Polish Baltic Sea zone include protection sensitive coastal areas against the risk of flooding associated with the Baltic level rise and ensuring the stabilisation of the coastline: beaches, cliffs and dunes against sea erosion.

Dune banks with moderate erosion tendencies can be protected by the use of fences or fascine bundles on the dunes to better capture wind-transported sand in the beach area, which promotes dune recovery after the storm season (autumn, winter). Additional protection is provided by planting special grass species on their crowns. An example of such shore protection using the principle of cooperation with nature is the model shore section: Lubiato – Białogóra, administered by the Maritime Office in Gdynia¹⁵⁹. Such a measure ensures the protection of many kilometres of dune shores on the Polish Baltic coast, including the sections Dębki –



Fig. 83.

Artificial vegetation on a reconstructed dune, Lubiato.

Photo: G. Różycki

Source: <https://klimada2.ios.gov.pl/katalog-dobrych-praktyk-adaptacyjnych/>

¹⁵⁸ <https://www.ckps.lasy.gov.pl/ochrona-gatunkow-i-siedlisk>

¹⁵⁹ Institute of Environmental Protection 2023. Dynakowska M. et al. Catalogue of good adaptation practices; <https://klimada2.ios.gov.pl/files/2024/Katalog%20dobrych%20praktyk%20adaptacyjnych.pdf>

Białogóra – Lubiatowo – Stilo – Łeba with minimal financial outlays and minimal interference with the environment.

Gabion core dunes are dunes rebuilt on shores with strong erosion tendencies, after their (almost) complete destruction, from sand delivered to the shore in the process of artificial beach recharge. To provide greater protection for the hinterland, baskets made of galvanised wire, additionally coated with PVC, are built into the newly shaped dunes and tightly filled with stones a few to several cm in



Fig. 84.
Skeleton of a dune without sand cover, Jastrzębia Góra – Ostrowo

Photo: G. Różycki

Source: <https://klimada2.ios.gov.pl/katalog-dobrych-praktyk-adaptacyjnych/>

diameter. The cores serve as the final line of shoreline defence against breakage and are able to withstand the pressure of the waves for an extended period of time during storms, when the dune material is washed away. The minimum lifespan of the structure is approximately 25 years. An example of the use of this solution are the dunes in the area of the base of the Hel Peninsula, where strong and very strong erosion processes occur (the area is administered by the Maritime Office in Gdynia)¹⁶⁰.



Fig. 85.
Kołobrzeg beach after the works, May 2015

Photo: G. Różycki

Source:

<https://klimada2.ios.gov.pl/katalog-dobrych-praktyk-adaptacyjnych/>

The large deficit of sandy sediments makes it ineffective to carry out artificial beach nourishment to raise the level and widen the area of the seashore without supporting measures such as shore

groyne, and/or submerged crest underwater sills, and/or traditional longshore breakwaters (with a submerged crest). For this reason, on shores with a high value of the hinterland, i.e. with a high value of the infrastructure located behind the beach, or with unique natural values in the immediate vicinity of the beach, more comprehensive methods of shore protection are used, consisting in the construction of underwater sills and spurs supplemented with artificial feeding. An example of such a solution is the beach in Kołobrzeg. The stabilisation of erosion processes will ensure the protection of a 3 km length of beach on a time scale of at least 50 years¹⁶¹.

¹⁶⁰ Ibidem.

¹⁶¹ Ibidem.

5.10. Protection of cultural heritage from climate change

An increase annual temperatures and prolonged periods of drought, as well as occurring weather phenomena such as above-normal rainfall or violent winds, are having an increasing impact on the operation of cultural institutions, architectural buildings, the maintenance of an appropriate interior microclimate in terms of protecting unique collections and the monuments themselves, and to a large extent on the preservation of historic gardens.

In the Royal Łazienki Park (Warsaw)¹⁶², due to the extension of drought periods with climate change, as part of measures in the historic garden space, aimed at restoring the historic layouts of the historic garden, plant species selections that are highly resistant to periods of prolonged drought or periodic flooding and extensively tended vegetation are being introduced. Mowing of selected zones is also reduced, which promotes better water retention. The dilemma remains whether to use plant species used in given historical periods or those used today.

The main threat and at the same time a challenge related to the impact of the negative effects of climate change on cultural assets at the Manggha Museum of Japanese Art and Technology in Kraków is local flooding caused by sudden and violent rainfall and flooding on the Vistula River. Extreme weather emergency plans are systematically updated to enable a rapid response and minimise damage to the stored collections. To this end, modern technologies are used to monitor and manage the threats of flooding and backwater effects in the city's sewerage network e.g., monitoring the level of filling of the combined sewerage network in the main collectors around the Museum building.

The National Archives is involved in projects in response to climate-related threats diagnosed for the security of archival materials. One of these concerns the protection of archival materials in the event of an emergency¹⁶³.

¹⁶² The park encompasses more than 74 hectares of green space, including some 8500 trees, among which are 4 natural monuments.

¹⁶³ <https://archiwa.gov.pl/poznaj/dla-instytucji-i-firm/zabezpieczanie-dokumentacji/zarzadzanie-kryzysowe/>

6. Monitoring and evaluation of adaptation actions and processes

6.1. Monitoring of adaptation actions and processes

Monitoring, reporting and evaluation of the adaptation process in Poland (MRE) is part of the evaluation of progress in increasing the resilience of society, the environment and the economy to climate change. This process involves regular monitoring at national and local level of the implementation of adaptation policies and actions. The indicator approach adopted is used to assess the effects of their implementation in terms of promoting adaptation to climate change.

The national strategic documents on climate change adaptation, Strategic adaptation plan for sectors and areas vulnerable to climate change by 2020 with the prospects until 2030 and the 2030 National Environmental Policy, include a list of performance indicators that are subject to annual measurement and reporting. The implementation of strategic projects in the Strategy for Responsible Development and the 2030 National Environmental Policy, which include various smaller adaptation actions and initiatives, is also subject to monitoring and reporting. The progress of the adaptation process in Poland is also assessed through a monitoring system for projects financed by EU funds using selected indicators of performance, results and environmental effects. The evaluation of projects from national funds operates on similar principles to those used by the NFEP&WM and voivodship funds. The achievement of specific indicators dedicated to climate change adaptation projects is monitored.

The monitoring of the status of implementation of the measures included in the urban adaptation plans is carried out by local authorities. Currently, cities that have adopted municipal adaptation plans (85 cities) prepare reports on the implementation of the plans on their own. The Ministry of Climate and Environment is also involved in this process, including as part of the sustainability monitoring of the 'Urban Adaptation Plan 44' project.

6.2. Assessing adaptation to climate change

The evaluation of the implementation of Strategic adaptation plan for sectors and areas vulnerable to climate change by 2020 with the prospects until 2030, carried out by the Ministry of Climate and Environment in 2021, provided knowledge and information on the adaptation process in Poland, which concluded that:

- There was progress in adaptation in all sectors covered by the strategy. In most sectors, there was at least some knowledge of the impacts of climate change and adaptation actions were identified.
- Resources for climate change adaptation activities were mobilised in all sectors. As of 2019, there has been a noticeable intensification of climate change adaptation activities across sectors and levels of government.
- Strategy documents related to climate change adaptation or minimising the negative impacts of climate change have been adopted in almost all sectors.
- The extent to which climate change adaptation has been integrated into the actions of the different sectors varies widely. Most action has been taken at government level in the energy and environment sectors.

- Awareness raising through communication, counselling, education and training is a prerequisite for government, local authorities, citizens and businesses to take and increase adaptation measures.

In October 2023, the EC published an assessment of progress in adaptation to climate change in EU MS – in accordance with the Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'). The Commission found that Poland was actively taking measures to increase its adaptive capacity and resilience to climate change. This assessment has been made using reports submitted by Poland in 2021 and 2023 with information on national climate change adaptation plans and strategies. Highlighting Poland's commitment to joint efforts to address the challenges of climate change, the EC pointed out e.g., that:

- Poland has stepped up its commitment to climate change adaptation in recent years in order to prepare for the diverse impacts of a changing climate;
- Poland has taken steps to update its adaptation strategy and improve coordination of adaptation measures by national authorities;
- Poland has made progress in vulnerability assessments, including at the sub-national level, and has provided guidance on the preparation of municipal adaptation plans;
- flood hazard maps and flood risk maps as well as flood risk management plans (FRMP) have been developed to reduce the potential negative impacts of floods;
- Poland has taken climate change impacts into account in its national disaster risk management framework and sectoral planning (including national civil protection plans, national disaster risk management plans, drought risk management plans, flood risk management plans and river basin management plans);
- Poland has made progress on initiatives, projects and activities aimed at increasing adaptive capacity. As a result of significant funding allocated to adaptation projects and as a result of various soft activities, i.e. preparation of guidelines, training, awareness raising and implementation of strategic projects by the Ministry of Climate and Environment and at all levels of government: local, regional and national, adaptive capacity is significantly increasing;
- as part of the Klimada 2.0 project, comprehensive risk assessments in seven areas (public health, biodiversity, forestry, road transport, agriculture, tourism and water management) were carried out using a multi-criteria risk analysis method;
- progress on climate change adaptation has been made at the sub-national level. NUP 2030 provides tools and solutions to help authorities in cities and urban functional areas across the country to implement local policies for sustainable development;
- local measures, such as local adaptation strategies and plans, have been strengthened to increase adaptive capacity. Polish municipalities, including cities, continue to develop local adaptation strategies and plans under the Covenant of Mayors initiative. All cities with more than 100,000 inhabitants and 106 cities with more than 20,000 inhabitants have an urban adaptation plan;
- five Polish cities have joined the EU Mission of 100 Climate-Neutral and Smart Cities, and 19 Polish regions and local authorities have joined the EU Mission on Adaptation to Climate Change.

On 18 December 2023, the EC made the following recommendations on the coherence of Poland's actions with the EU goal of climate neutrality and ensuring progress on adaptation:

- establish an appropriate legal framework for climate change adaptation policies and actions;
- ensure that adaptation priorities, strategies, policies, plans and efforts are proportionate to anticipated future risks and threats, in line with the best available knowledge and climate forecasting and early warning tools;
- ensure systematic and regular monitoring and evaluation of climate change adaptation policies; the results of monitoring will be taken into account in the development of the strategy update and during implementation.

7. Information related to averting, minimizing and addressing loss and damage associated with climate change impacts

7.1. Observed and potential impacts of climate change

This Chapter presents issues related to climate impact in terms of damage and losses caused by weather extremes in Poland, primarily in the context of the impact of phenomena of a sudden character. A description of the potential impacts of climate change is included in Chapters IV.1. and IV.2. Issues related to financial assistance to developing countries (development aid) for the implementation of measures related, inter alia, to mitigation of losses and damages associated with the effects of climate change are included in Chapter IV.8.

Poland collects and analyses information on the impact of extreme weather events on selected sectors. The method of damage and loss estimation functioning in Poland is based on the estimation of direct damage (damage to infrastructure, loss of crops, loss of insured property). However, the data are mostly dispersed (included in the statistics of various institutions responsible for dealing with the consequences of the phenomena in individual sectors) and are not systematically included in the publicly available statistics of the Statistics Poland. Many institutions in the country keep records of estimated losses caused by weather phenomena for their own purposes. Detailed analyses cover infrastructure of local government units, agriculture, forestry and water management. The main purpose of the estimates is to distribute aid for extreme events to the most affected entities and individuals. Information on the impact of emergency events is also collected by the SFS (number of Fire Service interventions)¹⁶⁴. Valued non-economic damages (loss of health, destruction of national heritage) are not included in the databases.

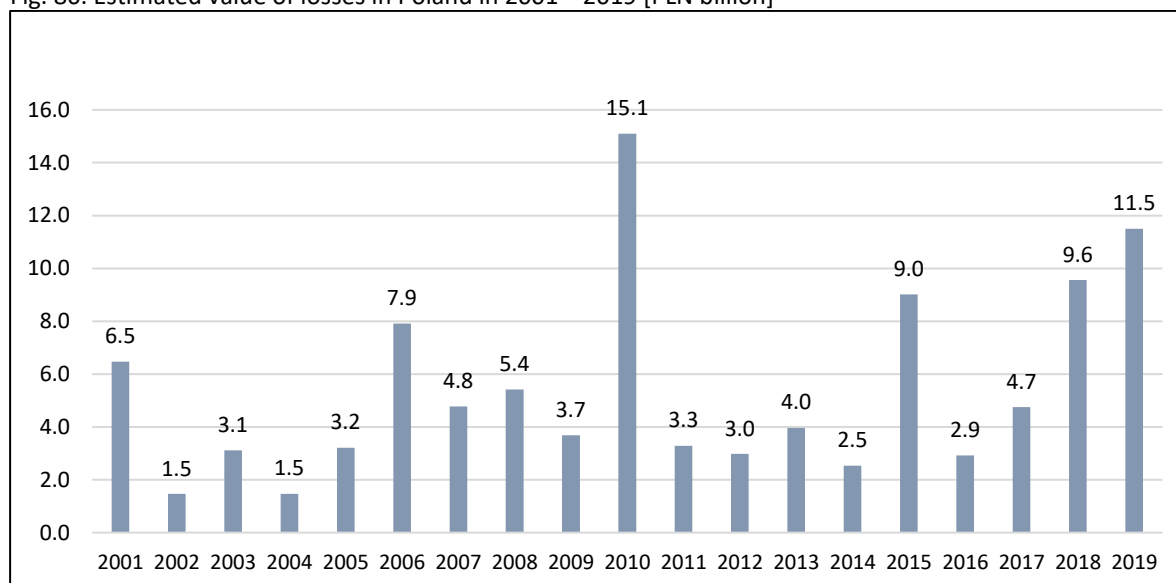
Research conducted by the Institute of Environmental Protection – National Research Institute shows that losses caused by extreme events occur annually in Poland. In the previous decade, Poland had to deal with the effects of excess water, while now, nationwide, losses caused by water scarcity are becoming a problem. While prior to 2010, damage to infrastructure due to flooding was the most common, in 2011-2019 the costs of water scarcity phenomena are felt most by agriculture. The problem of emerging financial losses also affects urbanised areas and the infrastructure of local government units, where flooding is occurring due to, among other things, increasingly intense torrential rainfall and an increase in the proportion of paved surfaces.

Analyses have shown that since 2001, Poland has lost an average of PLN 6 billion annually due to extreme events (Fig. 86). Every year, extreme phenomena cause losses representing between 0.1% and 0.4% of GDP. Above-average losses in the analysed period appear cyclically and account for between 0.5% and 1% of Poland's GDP¹⁶⁵. Above-average losses occur especially in those years when extreme events affect the agricultural sector or floods occur (2001, 2010).

¹⁶⁴ <https://www.gov.pl/web/kgpsp/interwencje-psp>

¹⁶⁵ https://klimada2.ios.gov.pl/files/2023/Atlas_skutkow_zjawisk_ekstremalnych_w_Polsce.pdf

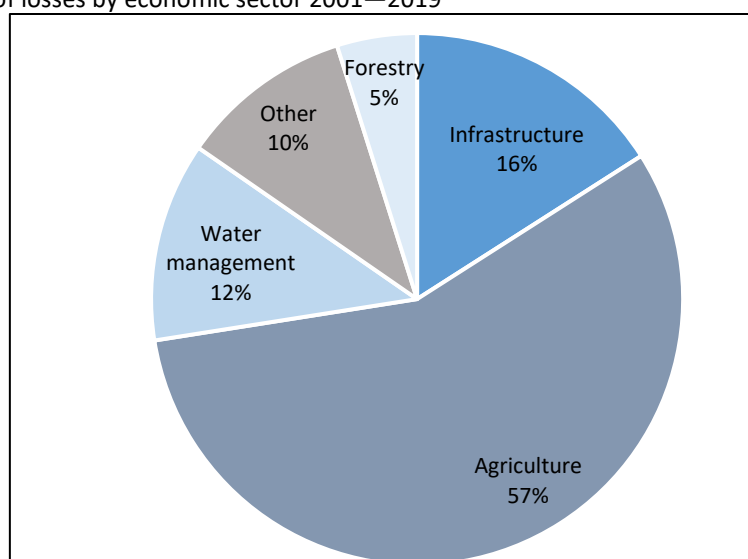
Fig. 86. Estimated value of losses in Poland in 2001—2019 [PLN billion]



Source: Siwec E. (ed.) *Atlas of the effects of extreme phenomena in Poland, Klimada2.0.*

The sector where extreme events cause the highest losses is agriculture. These include crop damage, animal losses, damage to orchards, perennial plantations, damage to fixed assets (including machinery, equipment, tractors and cars). Losses in the agricultural sector account for more than 50% of all losses estimated in the economy in the period 2001—2019. Other sectors with a high percentage of starts caused by extreme events are municipal infrastructure, water management and forestry.

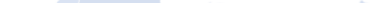
Fig. 87. Percentage of losses by economic sector 2001—2019



Source: Siwec E. (ed.) *Atlas of the effects of extreme phenomena in Poland.*

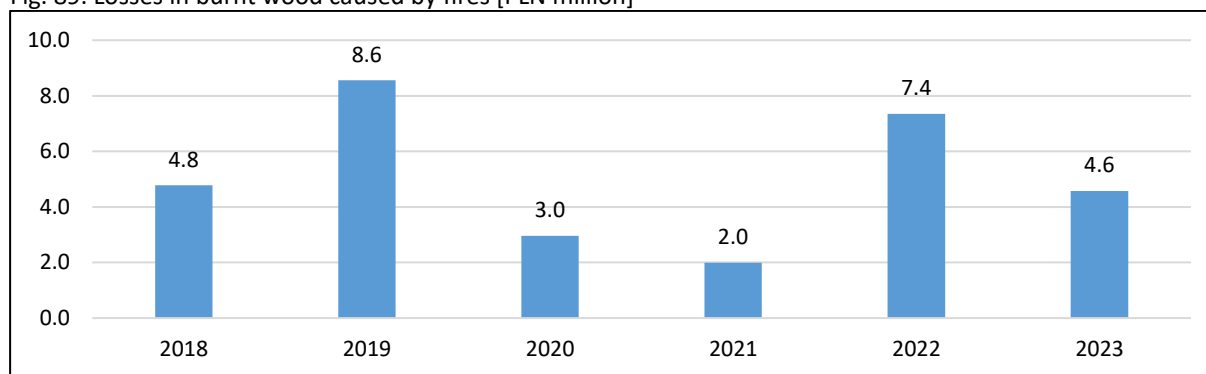
The Agricultural Drought Monitoring System (ADMS) of the Institute of Soil Science and Plant Cultivation – National Research Institute plays an important role in assessing the impact on the agricultural sector. The system contains computer applications integrating meteorological data needed to calculate the climatic water balance (CWB) and data from a digital soil-agricultural map showing spatial variation of water retention of different agronomic categories of soils. Two factors are taken into account in determining the areas threatened by agricultural drought for individual crops in the ADMS: weather conditions and the susceptibility of soils to drought. Monitoring of agricultural drought in Poland is carried out for the following groups and species of plants: winter cereals, spring

In the case of infrastructure of local government units, the financial losses estimated in 2018-2023 amounted to approximately PLN 4.7 billion, of which nearly PLN 352 million of losses were estimated in 2022-2023. The voivodships most affected, in which local government units recorded the highest financial impact, were the Dolnośląskie, Małopolskie, Mazowieckie, Podkarpackie and Świętokrzyskie voivodships. Damage to infrastructure was most often caused by events related to the impact of heavy rainfall, flooding and flash floods, as well as strong winds.



The costs of remediation in forestry over the past five years amounted to approximately PLN 1.1 billion, of which nearly 45% of the total remediation costs attributable to the analysed period were estimated for 2022-2023. The cause of the emerging losses was primarily strong winds damaging forest stands. Losses caused by forest fires in burnt wood material were estimated at approximately PLN 30 million, of which nearly PLN 12 million were losses in the years 2022—2023.

Fig. 89. Losses in burnt wood caused by fires [PLN million]



Source: study by IEP-NRI based on data from the State Forests

It is also worth noting that although man is the most common cause of fires (only 1% of all fires are caused by natural causes, i.e. lightning) undoubtedly periods of drought increase the risk of fire.

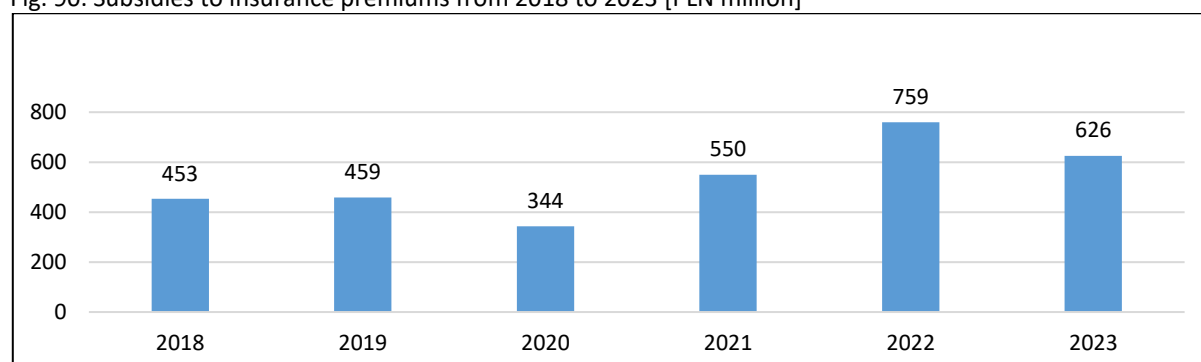
It is estimated that the natural losses caused by fires can be several times higher than the losses in burnt wood.

7.2. Actions and institutional mechanisms related to averting, minimizing and addressing loss and damage associated with the adverse effects of climate change

Regarding activities related to averting, minimizing and addressing loss and damage, diverse funding mechanisms and tools play a key role in supporting those affected by extreme weather events.

In agriculture, as part of measures to prevent the effects of adverse weather events, preferential agricultural insurance has been introduced for agricultural holdings. Subsidies from the state budget to premiums for concluding insurance contracts for crops against the risk of damage caused by hurricane, flood, heavy rain, hail, lightning, landslide, avalanche, drought, negative effects of overwintering and spring frost are applied, as well as subsidies from the state budget to premiums for concluding insurance contracts for animals against the risk of damage caused by selected extreme phenomena.

Fig. 90. Subsidies to insurance premiums from 2018 to 2023 [PLN million]



Source: study by IEP-NRI based on data from Ministry of Agriculture and Rural Development

More than PLN 3 billion in insurance subsidies for agricultural crops and livestock were provided between 2018 and 2023, of which PLN 1.3 billion amounted to insurance subsidies between 2022 and 2023.

In addition, depending on the occurrence of extreme phenomena, agricultural producers benefit from the possibility of applying for financial assistance due to crop losses caused by adverse weather events. Affected farmers may receive support in the form of loans for the resumption of production on agricultural holdings and special divisions of agricultural production where damage caused by drought, hail, heavy rain, adverse of overwintering, spring frost, flood, hurricane, lightning, landslide or avalanche has occurred.

At the disposal of the Minister of Interior and Administration, there is a specific reserve of the state budget (part 83, item 4) entitled: Counteracting and removing the effects of natural disasters, including PLN 889 986 thousand for the implementation of the 'Flood protection project in the Odra and Vistula river basin' (item 7).

The special purpose reserve makes it possible to support local government units and inhabitants affected by extreme events (floods, flash floods, windstorms, etc.) in the form of:

- 1) targeted allowances for families or single persons affected by events which are characteristic of disasters;
- 2) purpose-specific subsidies from the state budget for co-financing the tasks of local government units related to renovation, reconstruction and reconstruction of buildings destroyed or damaged as a result of events related to natural disaster;
- 3) purpose-specific subsidies from the state budget for co-financing self-government tasks involving repair, reconstruction, construction, relocation, stabilisation and improvement of public infrastructure destroyed, damaged or threatened by landslide movements or coastal erosion.

In water management, the implementation of damage repair tasks is carried out within the framework of the annual Programme for the implementation of tasks related to the maintenance of water and other property of the State Treasury related to water management. In the years 2018—2023, the costs of such tasks amounted to approximately PLN 171.8 million, of which approximately PLN 33.2 million were incurred in the period 2022—2023. In addition, in 2021, approximately PLN 5.2 million were disbursed under the special purpose reserve – 61 tasks were implemented at that time, which resulted from projects related to the removal of damage caused in the south of the country due to rapid rainwater run-off.

In forestry, the amount of funding granted for the reconstruction of the infrastructure of the Regional Directorates of State Forests in the period 2018—2023 was estimated at approximately PLN 39 million.

Damage and loss prevention is also supported through EU funds, particularly through the European Funds for Infrastructure, Climate, Environment 2021-2027 Programme and the European Funds for Eastern Poland.

In the European Funds for Infrastructure, Climate, Environment 2021-2027 Programme, within the framework of Action FENX.02.04 Adaptation to climate change, prevention of disasters, the following is co-financed: activities related to the development of risk management systems through the development of environmental forecasting and warning systems. The development of forecasting against meteorological and hydrological threats will be implemented, in particular through the construction of a flash flood warning system, as well as a widely understood fire prevention system in forest areas and national parks.

Support will be targeted at the rescue and forestry services whose presence is essential in the event of natural and man-made disasters (including those related to forest and national park fires). It will include the purchase of equipment for rescue operations and for removing the consequences of natural threats and major accidents.

In the case of European Funds for Eastern Poland, under Priority FEPW.02 Energy and Climate, Measure FEPW.02.02 Adaptation to climate change is implemented. The support is aimed e.g. at reducing vulnerability of cities to unfavourable weather phenomena and creating conditions for stable socio-economic development in the face of climatic risks. The supported adaptation measures are coherent and integrated undertakings, comprehensively affecting the adaptation of cities to extreme weather conditions, the development of green and blue-green infrastructure in cities, rainwater and snowmelt management, and the elimination of urban heat islands. It is possible to co-finance such measures as e.g., systems (including equipment and installations and the way the land surface is shaped) to prevent and reduce the effects of flooding and inundation, increase soil absorption, slow down runoff and water retention with distribution systems during droughts. The document that sets out the directions of action for preventing, counteracting, removing and preparing for the occurrence of various types of threats, including natural hazards associated with the occurrence of emergency events, is the National Crisis Management Plan (NCMP). The NCMP is a planning document, prepared by the Government Centre for Security in cooperation with ministries, central offices and voivodships, based on the Act on Crisis Management.

The NCMP, in accordance with the Act on Crisis Management, is updated at least once every two years, but also when, as a result of the launch of procedures, the need is identified to correct or supplement a given procedure or in the event of changes to legal acts relevant to the functioning of the NCMP.

In 2021, the Council of Ministers also adopted the next (fifth) edition of the Report on National Security Threats. The document comprehensively describes threats grouped into five main categories, including natural threats. A new and very important element of the Report is the direct identification of threats related to climate change, such as drought, flooding or strong winds, and the recommendation of actions to reduce the likelihood or consequences of the occurrence of a given threat. Information on the national disaster risk reduction strategy is reported annually as part of the Sendai Monitor. The Government Centre for Security has become the national contact point for the implementation of the programme.

One of the important measures to prevent loss and damage is the Government Centre for Security Alert that has been implemented – this is an SMS alert system for threats that may pose a threat to life. Government Centre for Security Alert is created based on information received from central and voivodship ministries, services, offices and institutions. Government Centre for Security alerts are sent in extraordinary situations, often related to extreme events, when life or health is directly threatened. It is received by people in the area of potential threat. The warning message is intended to help avoid the danger or minimise its effects. SMS messages warning of life-threatening emergencies are free of charge and no operator can charge extra for them.

Many aspects related to the issues of preventing, minimising and counteracting losses and damages associated with the effects of climate change at the national level require further research and analysis, so scientific work is being carried out that develops issues related to the assessment of indirect losses (non-economic damages) or methods for modelling the effects using climate risk. In addition, individual institutions are carrying out their own research on issues related to climate change impacts.

8. Cooperation, good practices, experience and lessons learned

8.1. Measures to share information, good practices, experience and lessons learned

Knowledge about climate threats and ways to adapt to climate change is communicated in a wide range of methods and forms of dissemination. The report presents only some examples of initiatives considered important for the process of climate change adaptation in Poland. It should be noted that the categorisation of the undertaken activities into a specific group is quite conventional due to their complexity.

8.1.1. Science, planning and policy relevant to adaptation

Building the knowledge base on climate change and its dissemination to improve the effectiveness and efficiency of adaptation actions in climate-sensitive sectors is the objective of the Klimada 2.0 portal - Climate Change Knowledge Base¹⁶⁶ (<https://klimada2.ios.gov.pl/>). The knowledge base was created as part of the project implemented by the IEP-NRI 'Knowledge base on climate change and adaptation to its impacts and its dissemination channels in the context of increasing the resilience of the economy, environment and society to climate change and counteracting and minimising the effects of extraordinary threats', co-financed from OPI&E 2014-2021. Tools have been provided to support decision-making and adaptation planning at the local level:

- Climate change scenarios for the area of Poland until 2100 according to RCP4.5 and RCP8.5 scenarios;
- Climate change risk assessment for selected sectors e.g., agriculture, public health, water management, biodiversity, forestry, transport and tourism;
- Centre for Legal and Climate Studies;
- Catalogue of adaptation actions and how to implement them (practices);
- Catalogue of good adaptation practices;
- Numerous publications, including Atlas of the effects of extreme phenomena in Poland, covering the most severe extreme phenomena in the country for the period 2001-2019; Macroeconomic effects of implementing climate change adaptation measures in Poland; Cost-benefit analysis of adaptation measures as support for decision-making.

A compendium of knowledge on the variability of air temperature, precipitation, climatic water balance or extreme weather events is provided annually in the reports 'Climate of Poland' (<https://www.imgw.pl/badania-nauka/klimat>) updated by the IMGW-PIB. Knowledge on meteorological and hydrological phenomena in Poland in the form of historical measurement and observation data is also provided (<https://danepubliczne.imgw.pl>).

Indication of areas with crop drought losses¹⁶⁷ is the aim of the Agricultural Drought Monitoring System (ADMS) run by the Institute of Soil Science and Plant Cultivation – National Research Institute (<https://susza.iung.pulawy.pl>). The system contains computer applications integrating meteorological

¹⁶⁶ <https://klimada2.ios.gov.pl>

¹⁶⁷ Act of 7 July 2005 on crop and livestock insurance (Journal of Laws of 2019, item 477).

data needed to calculate the climatic water balance (CWB) and data from a digital soil-agricultural map showing spatial variation of water retention of different agronomic categories of soils¹⁶⁸.

Information on the hydrogeological situation in Poland is provided by the results of groundwater monitoring carried out by the Polish Geological Institute – National Research Institute in the national groundwater observation and research network, and announcements on the current and forecast hydrological situation in groundwater recharge and abstraction zones, as well as hydrogeological warnings issued by the Institute during periods of threat. Maps of landslide vulnerability, maps of landslide hazards and risks as well as warnings on landslide hazards issued by the Polish Geological Institute – National Research Institute are provided¹⁶⁹.

Disseminating knowledge about the Earth's climate system and adaptation to climate change is also the task of institutions and NGOs. Educational activities are carried out on the causes, nature and rate of climate change and methods of adaptation to these changes.

8.1.2. Policy innovation and pilot and demonstration projects

The Department of Innovation of the Statistics Poland, together with the Institute of Geodesy and Cartography, led efforts to develop a method for measuring the area and quality of green spaces within the project 'GAUSS (Generating Advanced Usage of Smart Statistics) – advanced use of Earth observations for smart statistics'¹⁷⁰. The consortium consisted of scientific institutions: the National Observatory of Athens, the Finnish Meteorological Institute, the Institute of Geodesy and Cartography in Warsaw, which cooperated with national statistical offices and the private entity Evenflow.

The analysis, selection and evaluation of nature-based solutions to facilitate cities' pollution reduction and environmental renewal with a particular focus on strengthening climate resilience is the subject of work in the scientific project UPSURGE¹⁷¹ – Strengthening the implementation of nature-based solutions in cities within the framework of the established European Regenerative Urban Lighthouse. The project is implemented by a consortium of entities with significant participation of the Institute for Ecology of Industrial Areas from the Horizon 2020 Programme.

The project CICADA4CE – Effective management of climate change adaptation through the incorporation of ecosystem services integrated with social activities in Central European cities¹⁷² is implemented under the coordination of the Institute for Ecology of Industrial Areas within the INTERREG Central Europe Programme. It aims to strengthen climate change adaptation plans for urban areas by activating ecosystem services as efficient and economically beneficial ways integrated with technical solutions. This approach is also linked to social inclusion, fostering Ecosystem-based Adaptation (EbA) with Community-based Adaptation (CbA) programming at the same time.

¹⁶⁸ ADMS-integrated public application by means of which a farmer submits an application for the estimation of losses in agricultural crops where, in a given period, the possibility of a decrease in yields due to drought according to the climatic water balance has been indicated.

¹⁶⁹ <http://www.pgi.pl>

¹⁷⁰ <http://www.igik.edu.pl/pl/teledetekcja-gauss>

¹⁷¹ <https://www.katowice.eu/Strony/UPSURGE.aspx>

¹⁷² https://ietu.pl/projekty_post/cicada4ce/

8.1.3. Integration of adaptation actions into planning at different levels

A new challenge for adaptation in Poland is to plan activities at the regional level as part of shaping the development policy and vision of the region in the context of increasing severity of climate change. Work has started on the first Regional Climate Change Adaptation Plan for the Śląskie Voivodship¹⁷³. The document, which will be prepared by the IEP-NRI on the order from the Marshal's Office of the Śląskie Voivodship, will contain a plan for adaptation measures on the basis of a diagnosis, including an analysis of climatic phenomena and identification of the most vulnerable areas and sectors. The study will identify priorities and a framework for adaptation actions needed at regional and local level. The document is intended to prepare residents for increasing severity of climate change - to reduce vulnerability to extreme events and to increase capacity to prevent and combat the effects of such events. Cooperation and coordination between different sectors and institutions at regional level contributes to more effective solutions. Taking adaptation measures is also an opportunity for regional development, environmental protection and biodiversity, which contributes to the preservation of the region's unique ecosystems and species. As part of the development of the Regional Climate Change Adaptation Plan, the Marshal's Office of the Śląskie Voivodship will initiate a process of broad public participation that will aim to involve as many stakeholders, institutions and social groups as possible. These activities will be carried by e.g., workshops and meetings conducted on site in all four sub-regions of the voivodship.

The project entitled '*Strengthening coordination of climate change adaptation policies between local, regional and national authorities*' is in progress. As part of this project, residential training courses on climate change adaptation were organised for those implementing adaptation measures: Nature-based Solutions, Urban Retention, de-concrete (reduce concrete spaces), What is Climate Proofing, Spatial Planning and the Use of GIS Data, Landslides. The project is financed by the European Commission through the Technical Support Facility and implemented in cooperation with the Directorate-General for Structural Reform Support (DG Reform).

8.1.4. Cooperation to share information and to strengthen science, institutions and adaptation

One of the many activities to strengthen adaptation is the *City Partnership Initiative*, a programme in cooperation with the World Bank, which aims to exchange and promote knowledge between cities and other actors involved in the formulation and implementation of urban policies on how cities should conduct integrated urban policies. Topics of discussion include environmental and climate issues, i.e.: air pollution, urban greening and energy efficiency. More than 60 cities of different sizes and urban functional areas have participated in the two editions of this project.

Strengthening civil society in all possible dimensions also includes tackling climate change. Among the tasks supported by horizontal programmes managed by the National Freedom Institute – Centre for Civil Society Development, dedicated to NGOs of all kinds, the following undertakings can be pointed out:

1. *Climate-friendly Wrocław* task – adaptation to climate change for the inhabitants of Wrocław implemented by the Ekopotencjał Foundation (FIO competition Edition 2020). The project

¹⁷³ <https://powietrze.slaskie.pl>

consisted of a series of study tours and ecological workshops for the inhabitants of Wrocław aimed at activating society around the community issue of global warming.

2. *'Climate for change'* task - stop climate change, start climate for change #climatechange - a pan-European campaign for a better future for climate migrants implemented by the Buy Responsibly Foundation (competition PROO-1b Edition 2020). The aim of the project was to strengthen citizens' awareness of the causes and effects of climate change (especially migration), its relationship to lifestyles and to promote active citizen involvement in order to eliminate the root causes of global warming. Materials were developed on the effects of climate change in the Global South as one of the key causes of migration, highlighting the interdependence with the current economic model and lifestyle. A strategic, participatory, innovative public awareness campaign was also developed to inform EU citizens about the causes and effects of climate change and possible remedial action.
3. *The task 'Are you on the topic of climate change? – I act locally, I think globally'* implemented by the *Lawendowa Alternatywa Foundation (NOWEFIO competition, Edition 2021)*. Addressed to children aged 6-13 and adults from the Ciepłowody and Ziębice Municipalities, the project aims to increase knowledge on climate change, improve social competences combined with increased knowledge on ethnic equality and promote activities that integrate the community, while shaping creative, versatile, active and aware citizens. Various forms of communication were used: interdisciplinary workshops, meetings and educational excursions.
4. *'The Youth Climate Leaders Academy in Radomsko'* task, implemented by the foundation *WiseEuropa - Warsaw Institute for Economic and European Studies* (competition NOWEFIO Edition 2021). The project was aimed at young people aged 14-19 in Radomsko and its immediate vicinity. The series of training sessions and public debates aimed to increase the involvement of young people in the life of the city, broaden their knowledge of global climate challenges and create opportunities to take concrete adaptation measures in their immediate surroundings. An element of the work was the use of local lawmaking tools, including the consultation of municipal planning documents.
5. *'The Good Climate Zone'* task, implemented by the *'Strefa' Foundation* (NOWEFIO competition, Edition 2022). The aim of the project was to increase the involvement of Łódź residents in local neighbourhood activity around the idea of 'less waste' and self-organisation. To achieve this, the beneficiary created 6 Neighbourhood Activity Zones bringing together citizens of Łódź around the idea of 'less waste', exchanges, self-organisation and volunteering. Neighbourhood activities were preceded by educational activities around the following issues: what is zero waste/ less waste, how to create community gardens, how to cultivate neighbourhood gardens, how to live more slowly focusing on relationships not consumption, how to make ethical purchases, how to organise neighbourhood volunteering.

The selected cities were invited to cooperate in a programme of strategic advice on energy transition and adaptation to climate change, provided by experts from institutes under the Ministry of Climate and Environment: IEP-NRI, Forest Research Institute and the National Centre for Nuclear Research within the Cities with Climate project. As a result, Climate Transformation Roadmaps were developed for 15 cities. A series of meetings was devoted to the issues of urban greenery indicators, nature compensation in cities, green civic budgeting or the preparation of urban adaptation plans. Part of the programme's budget (more than PLN 157 million) was allocated to grants for projects related to BGI, removal of impervious surfaces, sustainable management of rainwater systems, including increasing retention in urban ecosystems.

8.1.5. Area, scale and types of cooperation and good practices

The EU Climate Change Adaptation mission focuses on supporting EU regions, cities and local authorities in their efforts to build resilience to the impacts of climate change. The action contributes to understanding climate threats, developing strategies to build resilience to climate change and testing and implementing innovative adaptation solutions. The mission aims to support at least 150 European regions and communities to become more resilient to the threats posed by climate change by 2030. The mission involves 29 local government units from Poland. The following cities have joined the mission: Elbląg, Gdańsk, Jastrzębie-Zdrój, Konin, Lidzbark Warmiński, Lublin, Ostrowiec, Rabka-Zdrój, Rejowiec, Rzeszów, Świdnica, Świecie, Turek, Warsaw, Wrocław and Zakopane. Among the Polish municipalities that will participate in the programme are: Grodzisk, Janikowo, Łomża, Pieszyce, Sorkwity, Stare Babice and Wisznia Mała. The group of Polish local authorities also includes the Dolnośląskie, Podlaskie, Mazowieckie, Podkarpackie, Śląskie and Świętokrzyskie Voivodships.

The Ministry of Development Funds and Regional Policy participates in the Greening Cities Thematic Partnership of the Urban Agenda for the EU, which aims to develop good practices and promote legislative and financial solutions for urban greening in the EU.

In Poland, 5 cities (Kraków, Łódź, Rzeszów, Warsaw, Wrocław) have been selected to participate in the EU Mission: Climate Neutral and Smart Cities, which aims to support and promote 100 European cities in their systemic transformation towards climate neutrality by 2030 and transform them into centres of experimentation and innovation. The selected cities will develop City Climate Contracts, which include an overall plan to achieve climate neutrality in sectors, i.e. energy, construction, waste management and transport, and related investment plans. Citizens, research organisations and the private sector will be involved in the process.

The presentation and dissemination of good water management practices at farm level was the aim of the codes on water management in agriculture and horticulture developed on behalf of the Ministry of Agriculture and Rural Development by experts from the Institute of Soil Science and Plant Cultivation - National Research Institute and the Institute of Horticulture – National Research Institute:

- Code of Good Water Practices in Agriculture¹⁷⁴, in which good water management practices at farm, field and municipal level are made available.
- Code of good water practices in horticulture¹⁷⁵ with information and recommendations for horticultural farms on water conservation and water efficiency.

Local governments and NGOs play a major role in disseminating knowledge on climate change adaptation. Publications containing advice and examples of BGI solutions to be applied by individuals and institutions responsible for shaping space are available. There are many examples of publications promoting the inclusion in practice of activities using environmental assets to alleviate the problem of excess rainwater, water scarcity or urban heat island, including the Bydgoszcz *'Catalogue of Green-Blue Infrastructure. Part II. Guidelines and solutions'* (Municipal Waterworks and Sewage System Plant), Wrocław's practical guide *„Catalogue of good practices, part II, principles of sustainable rainwater management in a built-up area”*, *'Precious rainwater - a short guide on how to keep it on the plot'* by the Łódź Infrastructural Company, or *'Blue-green infrastructure for mitigating climate change in cities. Technical catalogue'* published by the Ecologic Institute and the Sendzimir Foundation.

¹⁷⁴ <https://www.gov.pl/web/rolnictwo/kodeks-dobrych-praktyk-wodnych-w-rolnictwie>

¹⁷⁵ <https://www.gov.pl/web/rolnictwo/kodeks-dobrych-praktyk-wodnych-w-ogrodnictwie>

8.1.6. Cross-border cooperation with neighbouring countries on adaptation to climate change

Interreg cross-border cooperation programmes coordinated or managed by the Ministry of Development Funds and Regional Policy pursue the climate change-related specific objectives identified in the Regulation (EU) 2021/1058 of the European Parliament and of the Council of 24 June 2021 on the European Regional Development Fund and on the Cohesion Fund. Objective 2.4 *'Promoting climate change adaptation and disaster risk prevention and resilience, taking into account ecosystem-based approaches'* is implemented by all programmes on the western (Three German-Polish programmes: with Mecklenburg, Brandenburg and Saxony) and southern (Czech-Polish and Slovak-Polish) borders and the Polish-Ukrainian programme. Objective 2.2 *'Promoting renewable energy in accordance with Directive (EU) 2018/200, including the sustainability criteria set out therein'* is implemented by the South Baltic Programme. Objective 2.7 *'Enhancing the protection and conservation of nature, biodiversity and green infrastructure, including in urban areas, and reducing all types of pollution'* is implemented by the Polish-Lithuanian, Polish-Ukrainian, Polish-Slovak, Polish-Czech and two Polish-German programmes (with Mecklenburg and Brandenburg).

Poland cooperates with the Slovak Republic, the Czech Republic, Germany, Ukraine and Lithuania in the area of border waters. This cooperation focuses on the assessment of water status, the field of hydrology and flood control on border waters and the implementation of tasks under the Water Framework Directive and the Floods Directive¹⁷⁶.

As part of the implementation of the Convention on Wetlands of International Importance, especially as habitat for waterfowl, two transboundary areas have been established in the Polish-Czech border region: Krkonoše/Karkonosze Subalpine peatbogs and Peatland of the Iżera River Valley¹⁷⁷. High peat bogs which are organic carbon stores are protected.

The 'Regional Climate Change Adaptation Plan for the Silesian Voivodeship' (mentioned above) is being developed as part of the LIFE project for the Adaptation of the Mining Areas (LIFE-IP COALA¹⁷⁸), whose main objective is to implement the 'Climate Change Adaptation Strategy for the Moravian-Silesian Region' and to introduce a system of adaptation and mitigation measures into the joint programmes of the Moravian-Silesian Region and local government units. The aim of the participation of the Śląskie Voivodeship is to cooperate, exchange experiences and use good practices of the Moravian-Silesian Region in the area of adaptation to climate change.

Promoting a climate-friendly borderland by counteracting the adverse effects of climate change and strengthening adaptation and mitigation, taking into account an ecosystem approach is the aim of the project PROADAPT - CLIMATE-FRIENDLY BORDER - Decision support for local climate change adaptation measures¹⁷⁹, within the framework of the Interreg programme Poland-Saxony 2021-2027. In the cross-border area Poland-Saxony, the construction of a decision support platform for adaptation measures and the creation of a Climate Competence Network with two centres in Chrośnica and Görlitz are planned to exchange experiences, strengthen international and regional cooperation.

¹⁷⁶ <https://www.gov.pl/web/infrastruktura/wspolpraca-miedzynarodowa-w-gospodarce-wodnej>

¹⁷⁷ <https://www.ramsar.org/document/transboundary-ramsar-site-krkonosekarkonosze-subalpine-peatbogs-czech-republic-poland-0>

¹⁷⁸ <https://www.lifecoala.cz/powietrze.slaskie.pl>

¹⁷⁹ <https://proadapt.info/>

8.1.7. Improving the sustainability and effectiveness of adaptation actions

It is planned to introduce a uniform system for monitoring and evaluation of the implementation of adaptation measures at the local level of implemented municipal adaptation strategies and plans. According to the bill, cities with a population of 20,000 or more will have to submit monitoring reports to the IEP-NRI by 30 June in even-numbered years through an electronic system. The Institute will review and analyse them. It will be able to make comments on the documents, and the mayor or town mayor will be obliged to take them into account within 60 days of receiving them. Based on the analysis of the reports, the IEP-NRI will prepare and submit to the minister responsible for climate, by 30 November of the even-numbered year, a summary. This information will then be included in the report to the EC, submitted every 2 years in odd-numbered years.

8.1.8. Actions to support developing countries in the design and implementation of national policies to adapt to climate change

Poland supported adaptation in developing countries through:

- 2019 contribution to the Adaptation Fund – USD 1 million;
- a contribution to the 1st replenishment of the Green Climate Fund (GCF) in the amount of USD 3 million (the GCF, according to decision 1/CP.16 of COP 16 in Cancun, was to be the main channel for new international funding for adaptation, currently 50% of GCF funds are allocated to adaptation projects).

In addition, a representative of Poland is nominated as a member of the Adaptation Fund Board.

8.2. Strengthening research and scientific knowledge on climate change

Addressing the challenges of climate change adaptation requires building up a body of sound knowledge about climate and its changes and the problems associated with them. There is also a need for research on monitoring and evaluating the effectiveness of adaptation.

8.2.1. Climate research and systematic observations and early warning systems

Climate research has been carried out in Poland for years. In the 21st century, there has been significant progress in research as a result of increased awareness of climate change issues. Scientific institutions can receive support from the government in this area. State policy is based on documents and strategies, resulting from the assumptions of the State Science Policy, and also concerning climate challenges and the broader environment.

Climate change research topics cover issues that can be divided into the following categories:

- past climate change research;
- modelling of climate processes;
- high latitude climate research;
- environmental, economic and social impacts of observed and expected climate change;
- analysis of variability in the occurrence of extreme events (heat waves, droughts, high wind speeds);

- the impact of human activity on the climate;
- social and political aspects of climate change.

Scientific research in climatology in Poland covers a wide range of topics. Leading research directions include physical climatology, climatology of highly anthropopressive areas, dynamic climatology, regional climatology, applied climatology and the study of climate change and the factors that trigger and enhance it.

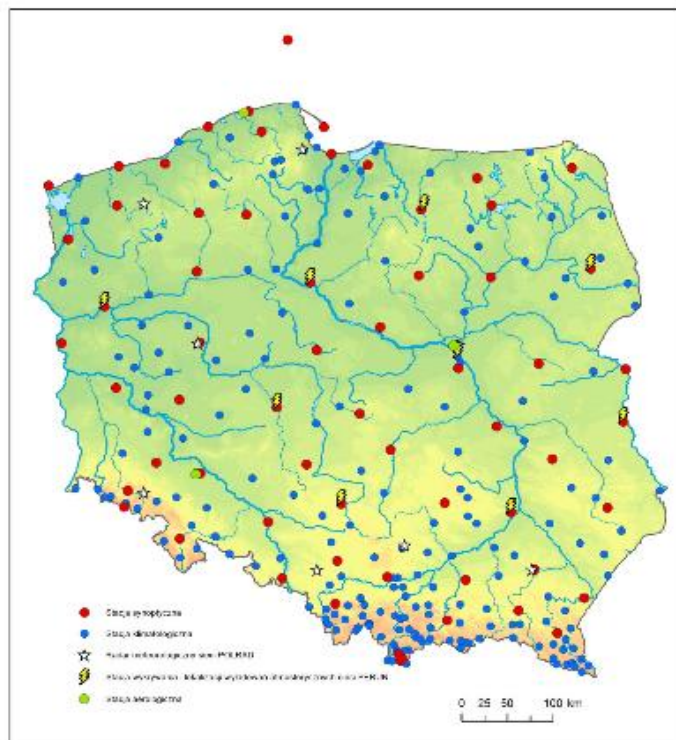
In addition to its own research, Poland participates in international research programmes such as:

- Horizon 2020;
- Future Earth international research programme;
- Biosphere Aspects of the Hydrological Cycle (BAHC);
- Global Land Project, Global Change and Terrestrial Ecosystems (GCTE);
- International Global Atmospheric Chemistry (IGAC);
- Past Global Changes (PAGES);
- Surface Ocean Lower Atmosphere Study (SOLAS);
- Land-Ocean Interactions in the Coastal Zone (formerly LOICZ);
- World Climate Programme (WCP);
- Global Climate Observing System (GCOS);
- Global Framework for Climate Services (GFCS);
- Intergovernmental Panel on Climate Change (IPCC), through the Polish IPCC Contact Point;
- European Global Ocean Observing System (EuroGOOS);
- FLUXNET Global Stream Observation Network;
- AERONET (Aerosol Robotic Network);
- Baltic Earth: Earth System Science for Baltic Sea Region;
- Joint International Programme for the Baltic Sea BONUS (Science for a Better Future of the Baltic Sea Region);
- International Network for Terrestrial Research and Monitoring in the Arctic (INTERACT).

Polish research and scientific institutions participate in modelling complex climate and weather phenomena within initiatives e.g., COST Action CA17109 DAMOCLES and consortia, e.g., COSMO, ACCORD, RC-LACE, ACTRIS, SatBaltic. Climate change modelling and forecasting now has increasingly large data sets at high spatial and temporal resolution, as well as taking advantage of the development of forecasting models allowing for increasingly better forecasts, which is particularly important in the context of implementing warning systems for severe meteorological and hydrological phenomena (e.g., Government Centre for Security messages, development of mobile applications e.g., Meto IMGW). Studies of the impact of climate change on the natural environment, on the other hand, focus on a variety of ecosystems, from natural (peatlands, forests, coasts, waters) to agricultural and urbanised. Socio-economic analyses, on the other hand, mainly focus on the impact of climate change on water management and population health, with a particular focus on urban areas, as well as on extreme weather events and their impact on the economy.

In Poland, observations and measurements within the global system of meteorological and climatic observation networks are carried out by the State Hydrological and Meteorological Service of the IMGW-PIB. These activities are carried out at 923 measurement points throughout the country, and their network implements a measurement and observation programme in accordance with WMO standards.

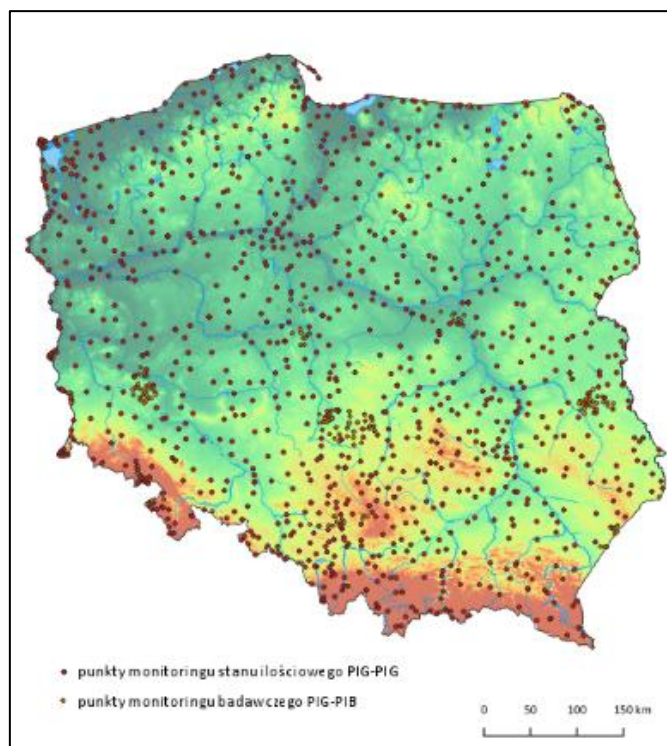
Fig. 91. Observation network of the IMGW-PIB (as at 1.01.2022)



Source: IMGW-PIB

Measurements and observations of the location of the groundwater table and yield of springs in the national groundwater observation and research network are carried out by the State Geological Survey, which is operated by the Polish Geological Institute – National Research Institute. Activities are carried out at more than 1500 monitoring points throughout the country.

Fig. 92. Groundwater research and observation network of the Polish Geological Institute – National Research Institute (as at 16.10.2024)



Source: Polish Geological Institute – National Research Institute

The marine environment of the Polish Baltic Sea area is studied by numerous scientific and administrative institutions. Research works are carried out by institutes of the Polish Academy of Sciences and universities, monitoring of the coastal zone, bays and lagoons of the Baltic Sea is carried out by Regional Departments of Environmental Protection, monitoring of fish resources and the state of the environment is carried out by the National Marine Fisheries Research Institute – National Research Institute, while monitoring of Polish sea areas is conducted by the Department of Oceanography and Baltic Monitoring at the IMGW-PIB. All monitoring of marine areas is part of the State Environmental Monitoring, the implementation of which is supervised by the Chief Inspectorate for Environmental Protection.

Outside the Baltic Sea, Poland conducts oceanographic research aboard the vessel s/y 'Oceania'. This craft, in addition to research cruises on the Baltic Sea, performs research on European northern seas - the North Atlantic and the Arctic. During the voyages, measurements are made in the fields of physics, hydrodynamics, chemistry, biochemistry, ecology and genetics of marine organisms. Universities and scientific institutes in Poland also carry out analyses of satellite images from an oceanological perspective.

Data from meteorological satellite systems are routinely used in Poland for meteorological, hydrological, marine and aeronautical cover of the country. Poland is a member of the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) and the European Space Agency (ESA), thanks to which it has access to data from meteorological and environmental satellites and participates in the work of these agencies aimed at developing satellite systems.

An element of the warning system against dangerous weather phenomena, which is to ensure common access to information on weather and climate threats (more in Chapter IV.7.2.) is a system of meteorological and hydrological warnings run by the IMGW-PIB. Issuance of a meteorological warning – a special type of information on the occurrence of an exceptionally hazardous weather phenomenon threatening human health or life, specified in a 4-grade scale of threat - mobilises crisis management centres and other services to increased readiness in the state of threat and enables the undertaking of actions aimed at protecting the society and infrastructure. Hydrological warnings e.g., information on the occurrence or possibility of hazardous hydrological phenomena, are also transmitted to the relevant state administrations. Hydrological warnings are issued on a 3-point scale with a maximum advance notice of 2 days. Hydrological drought warnings are issued in the form of information on a hazardous phenomenon, step-free and indefinitely from May to October.

8.2.2. Climate vulnerability and adaptation studies

Vulnerability to climate change and adaptation to the effects of climate change are the subject of a number of research conducted at research institutes, universities and institutes of the Polish Academy of Sciences. A selection of research projects is presented below.

Table 93. Research projects on climate threats and adaptation to climate change

Project Title	Project objective/description
CHASE-PL 'Assessment of the impact of climate change on selected sectors in Poland' ¹⁸⁰ (Polish-Norwegian Research Cooperation 2014-2017).	Providing scientific support for tackling climate change and its adverse impacts; analysed current and future climate change in Poland and its consequences for selected sectors.
CLIMPARK 'The role of urban parks in shaping the climate and bioclimate of the city, now and in the future' ¹⁸¹ (Institute of Geography and Spatial Planning of the Polish Academy of Sciences, 2022–2025)	Determining the impact of urban parks of different sizes, ages and structures on climate, identifying climate/bioclimate variation within parks and developing a model of the impact of parks on the urban heat island and the conditions experienced by users of urban space.
'Modelling the impact of climate change on regional competitiveness' ¹⁸² (Maria Curie-Skłodowska University in Lublin, 2020–2023).	Determining to what extent climate change will affect the competitiveness of selected regions in Europe. The scope of the work includes e.g., carrying out an analysis of the impact of climate change on the current competitiveness of the selected regions and simulating the impact of the effects of future climate change on the individual pillars of competitiveness and competitiveness as a whole.
'Impact of human activities and climate change on drought dynamics (transformation of meteorological drought to hydrological drought) and drought vulnerability' ¹⁸³ (Institute of Geophysics of the Polish Academy of Sciences, SHENG 1, 2019–2023)	A deeper understanding of the direct and indirect causes of drought and the processes governing the transformation of meteorological drought to hydrological drought are to increase knowledge of the dominant processes governing drought dynamics and its sensitivity to physical-climatic features. Project outcome: development of a methodology for adaptation to predicted human and climate impacts on lows, taking into account the uncertainty of future climate projections and societal developments.
TEACHER-CE joint Efforts to increase water management Adaptation to climate CHanges in central EuRope ¹⁸⁴ .	Development of an integrated toolkit for water resources management taking into account climate change issues. Polish research units – the Warsaw University of Life Sciences, the Institute of Meteorology and Water Management - National Research Institute - participate in the project; pilot studies are also being conducted on the Lower Silesian territory.
GrasSATGrasSAT – Tools for information to farmers on grasslands yields under stressed conditions to support management practices ¹⁸⁵ (Institute of Geodesy and Cartography, Poznań University of Life Sciences (PULS), Norwegian Institute of Bioeconomy Research (NIBIO), Norwegian Research Centre (NORCE), GEOMATIC M. Wyczalek-Jagielto; 2020–2023)	Development of a fully operational grassland production management system, mainly for medium and large farms in Poland and Norway. The project will develop a fully functioning platform in the form of a desktop and mobile application.
Mod4GrIn: Self-sustainable, smart module for city green infrastructure in climate change adaptation ¹⁸⁶ (Institute for Ecology of Industrial Areas in cooperation with the Norwegian Institute of Bioeconomy Research, CommLED Solutions; 2020–2023)	Development of a self-sufficient, intelligent modular system for green urban infrastructure – MOD4GRIN for buildings in urban spaces.
Climatic and water conditions of the Białowieża Forest ¹⁸⁷ (Forest Research Institute; 2021–2023).	Determination of trends of changes in ecoclimate and water resources of the Białowieża Forest and determination of stress factors for the forest and forecasting of changes that may threaten forest stands and water resources in the Forest in the future. The results will be used to develop remedial measures for forest ecosystems and indirectly for plant, animal and fungal species also for Natura 2000 habitats and species that are sensitive to the effects of climate change, especially changes in water conditions.
'Greenery in the centres of Polish cities. Status, functions and challenges' ¹⁸⁸ (Institute for Urban and Regional Development; 2022–2023).	Learning about the quantitative and qualitative status of the greenery in the centres of selected cities, the functions of green spaces in intensively urbanised areas and the challenges in managing urban greenery at times of climate change.
'Adaptation to climate change for national roads in Poland' ¹⁸⁹ .	Assessment of the vulnerability of the national road network to climate change, the costs and impacts of extreme weather events, identification of adaptation measures with a business case, in particular based on General Directorate for National Roads and Motorways data.

Source: study by the IEP-NRI

¹⁸⁰ Kundzewicz Z. W., Hov Ø., Okruszko T. (eds.). 2017. Climate change and its impact on selected sectors in Poland.¹⁸¹ https://www.igipz.pan.pl/project_pl/events/3_8793.html¹⁸² <https://www.pine.org.pl/wp-content/uploads/2022/03/energies.pdf>¹⁸³ https://projekty.ncn.gov.pl/index.php?projekt_id=418811¹⁸⁴ <https://programme2014-20.interreg-central.eu/Content.Node/TEACHER-CE.html>¹⁸⁵ <https://grassat.eu/strona-glowna/>¹⁸⁶ <https://www.mod4grin.eu/>¹⁸⁷ https://tbr.lasy.gov.pl/apex/f?p=102:3:::::P3_TEMAT:4863¹⁸⁸ Warchalska-Troll A., Pistelok P. (ed.). 2023. Greenery in the centres of Polish cities. Status, functions and challenges, Studies of the Urban Policy Observatory, Institute of Urban and Regional Development, <https://doi.org/10.51733/opm.2023.11>¹⁸⁹ Jaspers Team. 2023. Roads and Climate Change in Poland, a case study; <https://jaspers.eib.org/knowledge/publications/roads-and-climate-change-in-poland>

8.2.3. Monitoring and evaluation studies on the effectiveness of adaptation measures

It was decided to amend the Act Environmental Protection Law and some other laws, which aims, inter alia, to standardise adaptation measures at the local level, to introduce solutions to strengthen the climate-environmental dimension of urban policy, in particular to strengthen the ecological transformation aspects of cities, including the improvement of air quality. It is necessary to prepare rules for reporting on adaptation, including the assessment of the effectiveness of adaptation policies through indicators for monitoring adaptation measures. Work is currently underway to define a minimum list of such indicators.

Efforts are underway to develop a workshop for monitoring and evaluating the effectiveness of adaptation measures. One approach being explored is natural-climate indicators of urban development¹⁹⁰ including assessment of urban greenery and retention, impervious surfaces, urban heat island, biodiversity. Another, analyses of the applicability of the chosen indicator method to assess local climate change adaptation related to green infrastructure. Close access to public green space relative to the place of residence has been identified as a potential measure for achieving more equitable climate change adaptation in a city¹⁹¹.

¹⁹⁰ <https://www.gov.pl/web/klimat/przyrodniczo-klimatyczne-wskazniki-zrownowazonego-rozwoju-miast-przewodnik-dla-miast>

¹⁹¹ Romańczak A. et al. 2024. Accessibility of green infrastructure at the city scale on the example of Łomża and Siedlce. Available at: <https://doi.org/10.2478/oszn-2024-0001/>

V. Information on financial, technology development and transfer and capacity-building support provided and mobilized under Articles 9–11 of the Paris Agreement

Obligations under Articles 4.3, 4.4, 4.5 of the Climate Convention

In accordance with their obligations under the Climate Convention, developed countries (listed in Annex II to the Convention) are obliged to provide financial support targeted at developing countries (according to Article 4.3 of the CC). In the case of developing countries that are particularly vulnerable to the adverse effects of climate change, adaptation to these effects should also be funded (Article 4.4 of the CC). At the same time, all developed countries should work to promote, facilitate and finance the transfer, access and know-how for mitigation and adaptation technologies to fulfil the provisions of the Convention and the Kyoto Protocol (Article 4.5 of the CC). Poland is not a Party listed in Annex II to the Climate Convention. As such, it is not obliged to fulfil the obligations under Articles 4.3, 4.4 and 4.5 of the Convention. Since accession to the European Union in 2004, Poland implements a significant number of assistance programmes and activities on a purely voluntary basis, contributing pursuant to the provisions of Article 9.2 of the Paris Agreement.

1. National circumstances and institutional arrangements

Poland's development cooperation system is extensively described in Chapter 7 of the Report 8NC/5BR, 2022.

To monitor the support provided pursuant to the provisions of Articles 9-11 of the Paris Agreement, the Ministry of Climate and Environment collects information on the support provided from other ministries involved in the process. In Poland in 2021-2022, these were: Ministry of Foreign Affairs, Ministry of Finance, Ministry of Interior and Administration, Ministry of Development Funds and Regional Policy and Ministry of Climate and Environment. To increase the consistency of reported data, Poland uses the system agreed under the OECD DAC, while adapting the sector classification to the nomenclature resulting from the CMA decision.

Identifying private measures mobilised through public authority action is a more complicated matter. So far, Poland has not developed a reporting system for such measures and therefore does not include them in its report.

2. Basic assumptions, definitions and methodologies

The tables in Annex III have been completed in accordance with the following assumptions:

- Only projects disbursed in the calendar year 2021 and 2022 have been included.
- An exchange rate determined according to the OECD DAC methodology was used to convert the amounts when needed, i.e. PLN 3.8609/USD for 2021 and PLN 4.4577/USD for 2022. Some values have been converted from the PLN value posted on the payment date at a different rate and then recalculated in USD. Therefore, some amounts may differ from the amount received by multilateral institutions in USD.
- Climate finance. Financial resources allocated to activities related to climate protection, affecting the mitigation of GHG emissions as well as for adaptation measures, protecting people and the environment against the effects of rising temperatures, catastrophic phenomena, and capacity-building in partner countries to deal with the effects of climate change. Climate finance is delivered by Poland on a voluntary basis, pursuant to Article 9(2) of the Paris Agreement.
- Activities were reported on a 'disbursed basis', i.e. funds that were actually transferred in a given year were shown. As this financing has been provided pursuant to Article 9.2 of the Paris Agreement, these activities were treated as 'new and additional', going beyond the baseline scenario.
- The basis for identifying benefiting Developing Countries was the OECD DAC List of ODA eligible recipients.
- Financial flows not requiring repayment were defined as 'grant'. For 'loans', grant equivalents were given according to the OECD DAC methodology.
- All projects were classified as ODA according to the OECD DAC methodology.
- The eligibility of projects by sector followed the nomenclature of the categories described in the CMA decisions (i.e. 'Energy', 'Transport', 'Industry', 'Agriculture', 'Forestry', 'Water and Sanitation', 'Cross-Cutting', 'Other').
- The type of support was identified based on the project description and the Rio marker assigned.
- To minimise the risk of double counting, only projects financed with public funds paid in a given year have been included. The Polish contribution to the EU budget was not included, as projects implemented by the EU are covered by the EU BTR1. For projects implemented in several countries, only one project with a regional character has been included. For projects with several benefactors, only Poland's contribution to the project has been included.
- Only contributions considered as climate relevant using the Rio markers were included.
- The relevance of a given project for capacity building or technology transfer was assessed on the basis of data reported to the European Commission under the Energy Union Governance Regulation (Governance Regulation)¹⁹².
- For multilateral finance, projects are reported on an inflow basis

¹⁹² Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the 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 of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council

3. Information on financial support provided and mobilized under Article 9 of the Paris Agreement

3.1. Bilateral, regional and other channels

Information on financial support provided under Article 9 of the Paris Agreement through bilateral, regional and other channels in 2021 and 2022 is presented in Table 1 of Annex III.

3.2. Multilateral channels

Information on financial support provided under Article 9 of the Paris Agreement through multilateral channels in 2021 and 2022 is presented in Table 2 of Annex III.

4. Information on support for technology development and transfer provided under Article 10 of the Paris Agreement

Poland is implementing a programme aimed at the transfer of environmental technologies offered by Polish private entrepreneurs, called Greenevo. The programme is implemented by the Ministry of Climate and Environment and funded by the National Fund for Environmental Protection and Water Management.

Greenevo strengthens the business activity of Polish companies offering environmental technologies on a global scale. The programme supports private entrepreneurs by helping them to identify the needs existing in a given developing country and by informing Polish companies about the conditions of a given market (legal, technical etc.). Poland also informs its entrepreneurs about available country-specific support tools for the implementation of selected projects. At the same time, the Greenevo programme is a real support for the developing countries covered by its activities. Firstly, in this programme, Poland selects technologies with the participation of a panel of experts. Thus, it confirms the effectiveness of the proposed solutions and avoids the spread of unreliable technologies. Secondly, Poland analyses, with the help of experts and through contacts with the local administration and business community, which technologies participating in the Greenevo programme may be most useful in a given country. As a result, Greenevo missions to specific countries include companies that offer proven technologies, are interested in implementing projects in that market and whose technologies respond to local needs. In addition, in this programme, Poland helps national private entrepreneurs to establish contacts with local stakeholders, thus fostering international cooperation and the transfer of technologies and experience that can truly support developing countries in their climate ambitions.

5. Information on capacity-building support provided under Article 11 of the Paris Agreement

Most of the projects implemented by Poland are aimed at building local capacity. This is done through training in the use of donated equipment or a constructed installation, as well as – in many cases – preparing local users to train more people. Such approach creates space for local knowledge exchange and enables the multiplication of a given project.

To identify priority directions for capacity building, Poland uses its contacts with the government administration of the country concerned through direct contacts between Polish ministries and their counterparts, and contacts between Polish diplomatic missions and local stakeholders. If, among the local priorities, Poland identifies areas where Polish institutions could support local efforts and contribute to local capacity building, then cooperation is triggered. In some cases, establishing the exact scope of capacity-building support needed is actually the first step of an implemented project.

One example of reinforcing local capacities to respond to the consequences of climate change through increased collaborative approaches at the local level was a project implemented in Kenya by the Polish Humanitarian Action in 2022.

The project targeted local communities in three counties in southern Kenya (Kitui, Makueni, Machakos), where the dry equatorial climate prevails. As a result of the negative effects of climate change, access to safe water and adequate sanitation is an increasing challenge. As part of the project, 5 cooperatives gained access to water reservoirs. Innovative, environmentally friendly solutions were applied in the form of solar-powered water distribution systems. In addition, as a result of training carried out in management, cultivation and farming, the efficiency of agricultural work was increased and the production and income earning capacity of the agricultural cooperatives was enhanced. The project also aimed to improve the capacity of the farming community to adapt to climate change – both at the cooperative and county level. Building on experiences and know-how acquired during these activities, the project reinforced the capacity to reduce disaster risk (DRR), including by creating local DRR organisations regrouping the various cooperatives and reinforcing collaboration between them and with local authorities involved in the implementation of DRR activities at county level.

Another key area of Polish actions in this field is the reinforcing of local capacities to respond to emergencies and natural disasters resulting from climate change. An example of such an action, implemented in response to local needs and enabling further capacity-building, is the project run by the Fire Academy in Moldova. It concerned the support of the beneficiary – the General Inspectorate for Emergency Situations of the Ministry of the Interior of the Republic of Moldova – in the area of increasing the training capacity of the main Fire Service Training Centre, through the training and equipping of specialised instructional staff, as well as the development of training and teaching materials. This initiated the unification and standardisation of rescue training around the country. As part of the project implementation, the first firefighting training ground in Moldova was co-created in Razeni (about 30 km from Chisinau). A modern multi-module trainer for rescue operations was handed over to the Moldovan service, through which the acquired theoretical knowledge will be extended to practical knowledge. The trainer was constructed from five shipping containers set up in a form imitating a building with a staircase, doors, windows, a well and an installation for the generation and distribution of smoke in the interior space.

Poland also shares its own experience as an economy in transition e.g., in terms of sustainable urban development. The project implemented by the Polish Ministry of Development Funds and Regional Policy in 2021 involved supporting the Ukrainian administration in the implementation of the State Strategy of Regional Development of Ukraine for 2021-2027 with regard to urban development policy. Project measures were designed to reinforce the Ministry of Development of Communities and Territories of Ukraine in building the administration's capacity in urban development and revitalisation within the framework of regional policy at central, regional and local levels. The final outcome of the project is expected to be the creation of an efficient system for revitalisation as an instrument of regional policy and local development tool targeting cities. The overall objectives of the project include:

- Building professional, transparent, well-functioning system for public good and safety, in accordance with local and national regulations, including the key reforms resulting from the Partnership Agreement with the EU;
- Supporting urban planning and revitalisation processes, aiming at sustainable development – reflecting social and environment needs as well as mitigation of and adaptation to climate change;
- Improving the quality of life of urban residents, revitalising run-down neighbourhoods and modernising the utilities;
- Increasing access to urban public space and including public participation in urban planning.

An element of the project activities was to carry out an assessment of the needs and capacities of the Ukrainian administration in terms of conditions for carrying out revitalisation activities within the framework of Ukraine's regional policy. To assess the currently functioning institutional and legal system, national and local regulations and strategic documents were reviewed together with development and regional policy instruments and mechanisms in Ukraine. A questionnaire survey targeting the Ukrainian administration at various levels and other non-institutional actors regarding their organisational and financial readiness to carry out revitalisation activities was also conducted. As a result of the analysis, recommendations and proposals for a model for the implementation of the revitalisation process in Ukraine in the following years were developed as part of a project involving Ukrainian and Polish partners. The process of creating a revitalisation system in Ukraine was addressed to a group of 19 pilot Ukrainian cities, which confirmed their participation in the project. As part of the project, a series of workshops was conducted for representatives of the Ministry of Development of Communities and Territories of Ukraine and the pilot cities. The training contributed to capacity-building in terms of urban planning and reinforced cooperation between cities and experts in this field. An additional value of the project was that, as a result of the activities undertaken, a process of networking around the revitalisation process has been initiated in Ukraine between various institutions and organisations involved in regional and urban development. Universities, research institutes and NGOs from Poland and Ukraine were actively involved in this process.

Index of abbreviations

List of selected abbreviations used in the BTR1

Abbreviation	Meaning
AEA	annual emission allocation
AR5	The Fifth Assessment Report of the IPCC
BGI	Blue-green infrastructure
CAP	Common Agricultural Policy
CE	Circular economy
CGE	Computable General Equilibrium
CH ₄	Methane
CO ₂	Carbon dioxide
CO ₂ eq	Carbon dioxide equivalent
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
DECP	Drought Effects Counteracting Plan
EC	European Commission
EEA	European Environment Agency
EPBD	Energy Performance of Buildings Directive
EPP2040	Energy Policy of Poland until 2040
ERO	Energy Regulatory Office
ESR	Regulation (EU) No 2018/842 of the European Parliament and of the Council, the so-called ESR (Effort Sharing Regulation) and at the same time the ESR area, i.e. emissions from sectors not covered by the EU ETS (cf. EU ETS, non-ETS)
EU	European Union
EU ETS	EU Emissions Trading System
EUA	EU Allowance
EUAA	EU Aviation Allowance
EUR	Euro
FEnIKS	European Funds for Infrastructure, Climate, Environment 2021-2027 Programme
F-gases	Fluorinated greenhouse gases
FRMP	Flood Risk Management Plan
GDP	Gross domestic product
GHG	Greenhouse gases
GWP	Global Warming Potential
HFC	Hydrofluorocarbon
KOBIZE	National Centre for Emissions Management
ICAO	International Civil Aviation Organization
IEP-NRI	Institute of Environmental Protection – National Research Institute
IMGW-PIB	Institute of Meteorology and Water Management – National Research Institute
IMO	International Maritime Organization
kt	Kiloton [= 1 000 t] (SI unit of mass)
LTBRs	Long-term building renovation strategy
LULUCF	Land Use, Land Use Change and Forestry
MARPOL	International Convention for the Prevention of Pollution from Ships
MESSAGE	Model for Energy Supply Strategy Alternatives and their General Environmental Impacts
Mg	Megagram [= 1 million g] [= 1 t] (SI unit of mass)
MPGs	Modalities, Procedures and Guidelines
MS	Member State(s) of the European Union

Abbreviation	Meaning
Mt	Megaton [= 1 million t] (SI unit of mass)
Mtoe	Millions of tonnes of oil equivalent (a unit of energy)
MW	Megawatt (SI unit of power and energy flow)
MWe	Megawatt electric (SI unit of power and energy flow)
MWt	Megawatt thermal (SI unit of power and energy flow)
N ₂ O	Nitrous oxide
NAPCP	National Air Pollution Control Programme
NCMP	National Crisis Management Plan
NDC	Nationally Determined Contribution
NECP	National Energy and Climate Plan
NF ₃	Nitrogen trifluoride
NFEP&WM	National Fund for Environmental Protection and Water Management
Non-ETS	Non-ETS sectors covered by Regulation 2018/842 (so-called ESR); (cf. ESR, EU ETS).
NPS	National Power System
NRRP	National Recovery and Resilience Plan
NUP 2030	National Urban Policy 2030
NWMP	National Waste Management Plan
ODS	Ozone-depleting substance
OPI&E 2014-2020	Operational Programme Infrastructure and Environment 2014-2020
OWF	Offshore Wind Farms
PaMs	Policies and measures
PFC	Perfluorocarbon
PLN	Polish zloty
PNPP	Polish Nuclear Power Programme
RDP	Rural Development Programme
RES	Renewable energy sources
SF ₆	Sulphur hexafluoride
SFS	State Fire Service
SMR	Small Modular Reactor
STEAM-PL	Set of Tools for Energy Demand Analysis and Modelling – Poland
SUMP	Sustainable Urban Mobility Plan
t	tonne [= 1 Mg] [= 1 Mg] (SI unit of mass)
TEN-T	Trans-European transport network
TJ	terajoule (SI unit of work and energy)
TMRF	Thermal Modernisation and Renovation Fund
toe	Tonne of oil equivalent (unit of energy)
TWh	terawatt-hour (unit of heat, energy and work)
UNFCCC	United Nations Framework Convention on Climate Change
USD	US dollar
WAM	With additional measures
WEM	With existing measures

Annexes

Annex I. Common reporting tables for electronic reporting of information in national inventory reports of anthropogenic emissions by sources and removals of greenhouse gases by sinks (CRFs)

'A national inventory report (NIR) of anthropogenic emissions by sources and removals by sinks of greenhouse gases (GHGs)' and the Common Reporting Format Tables (CRF tables) have been reported by Poland to the UNFCCC Secretariat as separate documents and are available at: <https://unfccc.int/ghg-inventories-annex-i-parties/2023>.

Annex II. Common tabular formats on information necessary to track progress (CTF Tables)

1. Structured summary: Description of selected indicators.
2. Structured summary: Definitions needed to understand the NDC.
3. Structured summary: Methodologies and accounting approaches – consistency with Article 4, paragraphs 13 and 14, of the Paris Agreement and with decision 4/CMA.1.
4. Structured summary: Tracking progress made in implementing and achieving the NDC under Article 4 of the Paris Agreement.
5. Mitigation policies and measures, actions and plans, including those with mitigation co-benefits resulting from adaptation actions and economic diversification plans, related to implementing and achieving a nationally determined contribution under Article 4 of the Paris Agreement.
6. Summary of greenhouse gas emissions and removals in accordance with the common reporting table 10 emission trends – summary.
7. Information on projections of greenhouse gas emissions and removals under a 'with measures' scenario.
8. Information on projections of greenhouse gas emissions and removals under a 'with additional measures' scenario.
9. Projections of key indicators.
10. Key underlying assumptions and parameters used for projections.
11. Information necessary to track progress on the implementation and achievement of the domestic policies and measures implemented to address the social and economic consequences of response measures.
12. Appendix 1. Description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates.
13. Appendix 2. Methodology used to identify GHG emissions from international aviation and navigation in the scope of the EU's NDC.

Note: The attachment in the form of an Excel file contains the CTF tables for the national notification.

Annex III. Common table formats for electronic reporting of information on financial, technology development, transfer and capacity-building support provided and mobilised, as well as support needed and received, under Articles 9-11 of the Paris Agreement (CTF Tables)

1. Information on financial support provided under Article 9 of the Paris Agreement in 2022: bilateral, regional and other channels.
2. Information on financial support provided under Article 9 of the Paris Agreement in 2021: bilateral, regional and other channels.
3. Information on financial support provided under Article 9 of the Paris Agreement in 2022: multilateral channels.
4. Information on financial support provided under Article 9 of the Paris Agreement in 2021: multilateral channels.
5. Information on financial support mobilized through public interventions under Article 9 of the Paris Agreement in year 2022.
6. Information on financial support mobilized through public interventions under Article 9 of the Paris Agreement in year 2021.
7. Information on support for technology development and transfer provided under Article 10 of the Paris Agreement.
8. Information on capacity-building support provided under Article 11 of the Paris Agreement.
9. Information on financial support needed by developing country Parties under Article 9 of the Paris Agreement (NA).
10. Information on financial support received by developing country Parties under Article 9 of the Paris Agreement (NA).
11. Information on technology development and transfer support needed by developing country Parties under Article 10 of the Paris Agreement (NA).
12. Information on technology development and transfer support received by developing country Parties under Article 10 of the Paris Agreement (NA).
13. Information on capacity-building support needed by developing country Parties under Article 11 of the Paris Agreement (NA).

14. Information on capacity-building support received by developing country Parties under Article 11 of the Paris Agreement (NA).
15. Information on support needed by developing country Parties for the implementation of Article 13 of the Paris Agreement and transparency-related activities, including for transparency-related capacity-building (NA).
16. Information on support received by developing country Parties for the implementation of Article 13 of the Paris Agreement and transparency-related activities, including for transparency-related capacity-building (NA).

Note: The attachment in the form of an Excel file contains the CTF tables for the national notification.