

LOWER SILESIA ENERGY STRATEGY — DIRECTIONS OF SUPPORT FOR THE ENERGY SECTOR

WROCŁAW 2022





INSTITUTE FOR TERRITORIAL DEVELOPMENT (IRT)

UL. J. Wł. Dawida 1A
50-527 Wrocław
www.irt.wroc.pl
tel. +48 71 374 95 00

Document authors:

Maciej Zathey — IRT Director
Kamila Lesiw-Głowacka — Coordinator
Piotr Chmiel
Katarzyna Mańkowska-Bigus
Anna Pastucha

Photos by:

Przemysław Stasiak



FOREWORD

Dear Readers,

Energy determines life. The more we try to ascend to a higher level of civilisational development, the greater our responsibility for the rational management of resources and energy. The stable functioning of society and the economy largely depends on the condition of the energy system and the availability of energy sources. This is particularly evident at a time of crisis due to climate change, pandemics and war.

On 25 October 2022, The Management Board of the Lower Silesian Voivodeship adopted the **Lower Silesia Energy Strategy — Directions of Support for the Energy Sector**. It is a response to the identified challenges of Lower Silesia's development policy, defining the directions of actions of the Voivodeship's Local Government in line with the National Energy Policy and EU-level energy objectives.

Our planet's natural limit for absorbing greenhouse gases has been exceeded, which means that immediate and decisive action by all countries is needed to stop its degradation. Therefore, a strategic goal for Lower Silesia, in the context of energy policy, is to achieve climate neutrality by 2050. Achieving this goal depends on the energy transition based on

such things as energy sector decarbonisation, decentralisation and digitisation, and the launch of new sustainable energy sources.

The Strategy's operational objectives focus on improving air quality, supporting the development of energy technology research and innovation, increasing energy efficiency, supporting the development of renewable energy sources and energy storage technologies, supporting energy communities, improving energy security, and informing and educating the public.

The Strategy will be implemented using financial and organisational instruments managed by the Local Government of the Lower Silesian Voivodeship. The document will also be the basis for applying for additional external financing. Yet, achieving the objectives of the Energy Strategy is only possible with the cooperation of all administrative levels, the energy sector, business entities and social organisations.

The energy transition is the greatest civilisational challenge of the 21st century. We must act today. Together!

Cezary Przybylski
Marshal of the Lower Silesian Voivodeship



Contents

INTRODUCTION	5
SYNTHESIS OF THE "REPORT ON THE CONDITION OF LOWER SILESIA'S ENERGY SECTOR"	6
STRATEGIC OBJECTIVE	11
MISSION OF LOWER SILESIA'S LOCAL GOVERNMENT	11
VISION FOR THE FUNCTIONING OF THE REGION'S ENERGY SECTOR	11
The target model for the functioning of the region's energy sector by 2030,	11
The vision for the functioning of the region's energy sector by 2050	11
OPERATIONAL OBJECTIVE 1. AIR QUALITY IMPROVEMENT	16
Lines of action under Operational Objective 1.	17
OPERATIONAL OBJECTIVE 2. DEVELOPMENT OF RESEARCH AND INNOVATION	18
Lines of action under Operational Objective 2.	18
OPERATIONAL OBJECTIVE 3. HIGH ENERGY EFFICIENCY	19
Lines of action under Operational Objective 3.	21
OPERATIONAL OBJECTIVE 4. INCREASING THE USE OF RES AND ENERGY STORAGE TECHNOLOGIES	22
Lines of action under Operational Objective 4.	22
OPERATIONAL OBJECTIVE 5. COMMUNITY ENERGY	28
Lines of action under Operational Objective 5.	29
OPERATIONAL OBJECTIVE 6. ENERGY SECURITY	29
Lines of action under Operational Objective 6.	29
OPERATIONAL OBJECTIVE 7. INFORMATION AND EDUCATION	31
Lines of action under Operational Objective 7.	31
RECOMMENDATIONS AND REQUESTS	32
ADDRESSED TO THE POLISH GOVERNMENT	32
ADDRESSED TO LOCAL GOVERNMENTS.....	33
IMPLEMENTATION AND FINANCIAL FRAMEWORK	34
EVALUATION OF THE STRATEGY'S ALIGNMENT WITH EU, NATIONAL AND REGIONAL STRATEGIC DOCUMENTS	35
MONITORING AND EVALUATION	37
REFERENCES	38

INTRODUCTION

Human-induced climate change has catastrophic consequences. Research shows that unless contemporary trends of economic growth and territorial expansion of human civilisation are interrupted, the earth's surface temperature will inevitably rise, drastically affecting the quality of life of organisms. Global warming comprises an increase in the temperature of air masses and the concentration of greenhouse gases in the atmosphere, a global increase in water temperature and an ocean level rise, as well as a reduction in the mass of snow and ice. Scientists warn that if the increase in the Earth's global average temperature exceeds 1.5°C, future climate risks to the environment and anthropogenic systems will be greater, and the consequences could be long-lasting and irreversible!¹ Keeping the increase in the global average temperature well below 2°C, as stipulated in the "Paris Agreement", is only possible by **reducing greenhouse gas emissions across all sectors of the economy, particularly in the energy sector**. To counteract this effectively, net anthropogenic CO₂ emissions must be reduced by around 55% by 2030 compared to 1990, reaching zero (net) emissions by about 2050. Reducing CO₂ emissions to a level that will limit global warming to 1.5°C should involve **increasing the rate of decarbonisation (elimination of fossil fuels)**, applying energy efficiency-oriented measures and minimising the use of fossil energy resources.

In September 2015, the UN General Assembly adopted the 2030 Agenda for Sustainable Development (2030 Agenda) containing **17 Sustainable Development Goals** and related targets. They address goals in 5 areas: People, Planet, Prosperity, Peace, and Partnerships. The SDGs cover a wide range of challenges, such as poverty, hunger, health, education, gender equality and climate change. The year 2016 saw the EU adopt the "European action for sustainability" (COM(2016)739), thereby confirming the adoption of the Agenda.

Among the Agenda's 17 SDGs, **three are directly related to climate protection and energy transition:**

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all;

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation;

Goal 13. Take urgent action to combat climate change and its impacts.

Achieving these goals will be a vital step towards a climate-neutral European Union by 2050. Sustainable development

and transitioning to a safe, climate-neutral, resilient and more resource-efficient circular economy is key to ensuring a competitive economy and regional cooperation.

The EU analyses and strategies indicating the achievement of climate neutrality by 2050 set the direction for the Member States, which are obliged to align their national targets with the Community's. State action on energy and climate must be based on synergies between policies expressed in long-term strategies and law. In response to the challenges set by the European Union, Poland has created two documents: the "National Energy and Climate Plan for the years 2021–2030" (NECP 2030) developed in 2019 and the "Energy Policy of Poland until 2040" (EPP2040), adopted by the Council of Ministers in 2021, with assumptions for an update adopted in March 2022. Regardless of the intended progress of the national-level energy transition, the Lower Silesian Voivodeship should strive for climate neutrality by 2050.

The "**Lower Silesia Energy Strategy — Directions of Support for the Energy Sector**" refers to the global challenges of climate protection and the energy transition of civilisation. In addition, this regional document fits in with the objectives arising from EU and national energy and climate documents.

The current challenges and the need to take action focused on the energy transition require a regional development policy based on:

- 1) recognising the primacy of efforts to achieve climate neutrality by 2050,
- 2) meeting the EU climate and energy policy objectives,
- 3) ensuring the region's energy security,
- 4) shaping a regional energy infrastructure which takes into account the dynamic development of renewable energy sources,
- 5) strengthening cross-border cooperation,
- 6) rational and responsible use of financial resources for the energy transition.

The "Lower Silesia Energy Strategy — Directions of Support for the Energy Sector" identifies areas of support in the energy transition process and contributes to the implementation of EU and national objectives in this area. The document defines directions and guidelines to enable the region to achieve climate neutrality by 2050. The Lower Silesia Energy Strategy will be implemented through the activities of various entities using available funding sources, including under the relevant programme documents (for the form of implementation, see the "Implementation and financial framework" chapter).

¹ IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development,

and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.

SYNTHESIS OF THE "REPORT ON THE CONDITION OF LOWER SILESIA'S ENERGY SECTOR"

The ongoing climate change and human impact on it have been the focus of much scientific research. The results prove that global warming **will directly affect human health, increase poverty and worsen living conditions** (increased range of areas affected by infectious diseases, deterioration of air quality, more challenging working conditions and thermal stress), **including access to water and food. Reducing CO₂ emissions to a level that will limit global warming should be done through measures that reduce energy intensity, minimise resource use, increase the rate of decarbonisation, and capture carbon, primarily using the multifunctionality and role of forests in carbon sequestration.**

Stopping the temperature rise at 1.5°C is possible by drastically reducing emissions by 2030 and involves using such technologies and practices as electrification, hydrogen use, sustainable biomass-based feedstocks, product substitution, as well as carbon capture, use and storage. It is essential to strengthen multi-level governance and the capacity of institutions and to foster and develop policy instruments, technological innovation, the transfer and mobilisation of financial resources, as well as behavioural and lifestyle changes. Action to limit global warming relates to and should be pursued with many of the Sustainable Development Goals in mind. **It is estimated that actions will prove more effective if regional and local authorities are supported by national governments.**²

Given the above risks and challenges, the **European Union has subordinated EU legislation to the goal of reducing greenhouse gas emissions — mainly CO₂.** An important step in this direction was the conclusion of the so-called "**Paris Agreement**"³ in 2015, which involved representatives of nearly every country in the world. At that time, an agreement was reached and the **following commitments were made with a 2050 deadline:**

- a long-term goal of holding the increase in global average temperature below 2°C above pre-industrial levels,
- efforts to limit the global temperature rise to 1.5°C, as this would significantly reduce the risks and negative impacts of climate change,
- the need to reach, as soon as possible, a global tipping point (maximum emissions level) from which emissions will only decline — assuming that this will take longer in developing countries.

The Union's commitment to reduce greenhouse gas emissions was planned and set at national levels and then communicated

by the Union and its Member States to the UNFCCC Secretariat.

The EU began implementing the "Paris Agreement" by creating new energy legislation. On 30 November 2016, the Commission released a Communication titled "**Clean energy for all Europeans**"⁴, a package of legislative proposals (the so-called Winter Package). It aims to bring **EU legislation into line with the implementation of the 2015 energy union and, above all, to link energy and climate protection.** The idea behind the creation of an energy union is **to guarantee all Europeans access to secure, sustainable and affordable energy, as well as to create new tools for achieving ambitious climate goals.**

A milestone of the transition was the adoption of the Regulation⁵ that established **the five pillars of the energy union — energy security, an internal energy market, energy efficiency, decarbonisation and research, innovation and competitiveness** (Article 1(2)), which coincide with the energy policy objectives of the Treaty on the Functioning of the European Union (Article 194(1)). The above regulation recognises as a "**governance mechanism**" **the drawing up of long-term strategies by the Member States and the European Union**, which include integrated **National Energy and Climate Plans (NECPs)** for 10 years starting from the 2021–2030 period (Article 3). Hence, December 2019 saw the adoption of NECP for Poland, setting out the 2030 targets and directions. The NECP is binding at the EU level, and its assumptions should ensure policy transparency and predictability, as well as expediency of national spending. The document outlines national assumptions, goals, policies and measures relating to energy security, decarbonisation, energy efficiency, the internal energy market and research, innovation and competitiveness. The document assumes a 21–23% RES share in the energy mix by 2030 (the EC's expectation is a minimum of 25%). The implementation of the NECP targets will be evaluated by the European Commission, which makes this document superior to EPP2040.

In addition, the "Energy Policy of Poland until 2040" (EPP2040) has been developed at the national level. The EPP2040 is 1 of 9 integrated strategies stemming from the "Strategy for Responsible Development", setting the framework for a low-carbon energy transition in Poland based on 3 pillars: a just transition, a zero-emission energy system and good air quality. According to the EPP guidelines, by 2030, the share of RES should be 23% in energy production and 14% in transport, with

² IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press

³ "Paris Agreement" was affirmed by the European Union on 5 October 2016 based on Council Decision (EU) 2016/1841.

⁴ Communication From the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, Clean

Energy for all Europeans, Brussels, 30.11.2016 COM(2016) 860 final (<https://ec.europa.eu/transparency/regdoc/rep/1/2016/PL/COM-2016-860-F1-PL-MAIN-PART-1.PDF>) [accessed 22 December 2020].

⁵ Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on Governance of the Energy Union and Climate Action, amending Regulations (EU) 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. 21).

the share of coal power to be reduced to 56%, and nuclear power to be implemented starting from 2033. The assumed 30% reduction in CO₂ emissions by 2030 is, however, below the European Union's overall target of 55%.⁶ Further, the adopted assumptions for the EPP2040 update in the 2040 timeframe indicate an aim to generate around half of electricity from renewable energy sources.

Another notable development was "Fit for 55", a legislation package published on 14 July 2021 by the European Commission. It represents the official start of discussions on **measures to achieve the intermediate target by 2030 on the road to climate neutrality, i.e. a 55% reduction in CO₂ emissions in the European Union compared to 1990**. The "Fit for 55" package includes a structured approach to the transition, high ambitions, as well as pricing mechanisms to achieve the goal. However, for these rules to finally enter into force, they must be adopted by the EU countries and the European Parliament.

The "Lower Silesia Energy Strategy — Directions of Support for the Energy Sector" should make it possible to actively initiate and support the development of a system based on regional and local energy sources together with energy storage solutions.

In the next decade, due to the high share of coal in the domestic energy sector's fuel mix, there will be a significant increase in both electricity and heat prices. This is mainly due to the high cost of CO₂ emission allowances caused by the lack of early investment in modern, low-carbon energy sources. An increase in electricity generation costs and wholesale prices is to be expected, especially between 2021 and 2030. Distribution costs and end-user rates will also increase. Proportionally, heat consumers will be even more exposed to price increases. District heating costs will increase the most, with distribution costs rising to a lesser extent.⁷

The ongoing war in Ukraine and the reduction in the availability of fossil fuels have caused a major increase in energy prices and are threatening the economic stability of society.

The costs of fuel, electricity and heat⁸ have a significant impact on the functioning of households and the structure of their expenditure. They determine the competitiveness of businesses and the national economy as a whole. Any increase in the price of electricity and heat and the costs of their supply (distribution costs, taxes, charges) causes concern among consumers. One of the main challenges faced by the EU, as identified in European Commission documents, is energy poverty. This is due to a combination of low incomes, high energy expenditure relative to own income and poor energy efficiency, especially in the case of buildings. Today, **energy poverty is explicitly highlighted in EU directives and Member State policies, gradually becoming part of local government programmes**. This change can be attributed to the rising importance of the climate and concerns stemming from the consequences of liberalising the EU energy market, among other things. Further, **many stakeholders** — including NGOs,

regional associations and business groups — **are advocating for the integration of social, housing and infrastructure dimensions in energy policy-making**. The transition will also provide energy-poor households with easier access to affordable energy-efficient buildings and cheaper renewable energy by enabling citizens and consumers to take an active role in it.

From the local government's perspective, an important regulation is the obligation to apply at least one of the energy efficiency measures in public finance sector units.⁹ The amendment to the Act on Energy Efficiency and Certain Other Acts of 20 April 2021 (Dz.U./Journal of Laws/ of 2021, item 868) implements the provision of the Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 amending Directive 2012/27/EU on energy efficiency. **The amendment's most vital changes concern the applicable forms of financing for energy efficiency investment projects and the introduction of alternative tools to complement the energy efficiency certificate system. Moreover, it has also made it possible to implement the energy-efficiency obligation in the form of non-refundable subsidy programmes involving the implementation of end-user projects.** These programmes will mainly involve modernising end-user heating equipment or systems or replacing them with more energy-efficient ones.

Bearing in mind the obligations of the local government to apply energy efficiency measures, a survey of the condition of buildings owned by Lower Silesia's Local Government and its subordinate units was carried out as part of the work on the "Report on the Condition of Lower Silesia's Energy Sector".¹⁰ The following aspects of the buildings were determined: heating sources, electricity and heat consumption, thermal efficiency improvements (planned and implemented), as well solutions to reduce the environmental impact of the building's operation. The survey shows that the collected information can be a starting point for a system enabling the regular and coordinated collection of data on the condition of buildings and preliminary material for detailed analyses of the energy intensity of the relevant facilities.

Current efforts to carry out the energy transition and implement the European Green Deal, in addition to energy efficiency measures under the current legislation, must involve **radical lifestyle changes aimed at eliminating sources of CO₂ emissions**. Solutions reflecting **spatial policy need to be implemented, as space is also one of the limited resources managed by humans**. The way it is used, particularly the dispersion of buildings, **is associated with higher infrastructure connection costs and increased energy consumption, which includes fuels used to travel with air-polluting vehicles**. Increasing energy efficiency through spatial planning can be implemented by:

- limiting the dispersion of buildings,
- shaping spatial layouts by making effective use of local climatic conditions (ventilation, sunshine, evaporation, irrigation),

⁶ 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')

⁷ Institute for Renewable Energy, "Medium-term Energy Price Forecast until 2040", October 2020

⁸ as above

⁹ Act of 20 May 2016 On Energy Efficiency (consolidated text of Dz.U./Journal of Laws/ of 2021, item 468, as amended).

¹⁰ The "Report on the Condition of Lower Silesia's Energy Sector" is a diagnostic part of the "Lower Silesia Energy Strategy — Directions of Support for the Energy Sector".

- increasing built-up intensity (densification) and making efficient use of land use,
- minimising transport needs through comprehensive and functional land use and optimising the distance to traffic attractors,
- optimising investment project locations to minimise energy consumption,
- ensuring the efficient planning of transport systems, particularly public transport,
- creating green and blue infrastructure,
- restoring degraded areas,
- identifying areas for the development of distributed generation,
- energy-efficient buildings and comprehensive thermal efficiency improvements to existing facilities.

An efficient organisation of transport also plays a key role in reducing fuel and energy consumption. This must be based on an appropriate transport policy, primarily involving a reduction in transport demand, the use of low- or zero-emission modes of transport and technological and organisational measures to improve transport efficiency. **Local Government Unit actions should focus on supporting preferred transport systems (public transport, walking, cycling) over environmentally inefficient ones (based on combustion vehicles).** In Lower Silesia, these issues were included in the "Conditions and Guidelines for Developing Zero-Emission Transport in Lower Silesia — Cycling Mobility in Daily Commuting of Lower Silesia's Residents" adopted by the Management Board of the Lower Silesian Voivodeship.

Under the Treaty on the Functioning of the European Union (Art. 194 sec. 1), **promoting renewable forms of energy is one of the objectives of EU energy policy**¹¹. Increased use of renewable energy is an essential part of the bundle of measures needed to reduce greenhouse gas emissions and meet EU commitments. The "Paris Agreement" (2015), as well as the implementation of the EU's 2030 climate and energy policy framework, has set a goal for the EU to cut greenhouse gas emissions by at least 40% (now 55%) relative to 1990 levels by 2030.

The use of fossil fuels must be reduced due to the environmental effects associated with emissions during their combustion and the degradation of mining areas, and such fuels must be replaced by other non-emitting energy sources. The so-called energy mix of electricity and heat-generating sources is of fundamental importance, as is the structure of investments in new and efficient sources and the rate at which inefficient sources — especially those with the greatest environmental impact — are being phased out.

The biggest challenge for the energy sector is to replace the combustion of hydrocarbons (of limited and decreasing availability) and the associated greenhouse gas emissions (mainly CO₂) with energy obtained from RES. It is also necessary to promote the development of energy storage technologies on an industrial scale to ensure a continuous supply of energy around the clock. Currently, the world's most efficient energy storage facilities are pumped hydro energy storage (PHS) plants. At present, lithium-ion storage is the most popular and constantly evolving solution. Yet, for environmental reasons, the most desirable option is to store

electricity using hydrogen produced with RES electricity. In addition, hydrogen offers many potential applications in the industrial, transport, energy and construction sectors.

The inevitable rise in electricity and heat prices poses a growing challenge for energy and regulatory policy (support for an accelerated energy transition towards renewables) and social policy (assistance for vulnerable consumers). Active energy consumers should make the most of opportunities to improve energy efficiency and invest in their own energy sources (prosumerism).

To halt the rising electricity and heat prices as quickly as possible, it is necessary to simplify and shorten RES investment projects and to make active use of funding opportunities for such projects. Access to EU funds in this area is guaranteed by the EU's European Green Deal strategy and the so-called Green Taxonomy. **Energy consumers can actively shield themselves from rising costs by investing in energy efficiency improvements and shifting towards prosumerism.** In particular, investments in prosumer photovoltaic sources in households and small and medium-sized enterprises (SMEs) should be further accelerated.

Analyses show that there is increasing interest in obtaining energy from renewable sources in the **Lower Silesian Voivodeship**, much like in the rest of Poland. This is due to the aspiration to achieve the internationally agreed share of renewable energy sources in the country's energy mix, the decreasing prices of renewable energy, as well as the increasing environmental awareness of the public. Due to its location and topography, the region has varied conditions for the development of wind energy and relatively good conditions for solar and biogas energy solutions. The Lower Silesian Voivodeship also has varied potential in terms of geothermal conditions. The existing geothermal potential has not been sufficiently explored, so further research should be conducted to identify areas with potential for geothermal development, especially in the area of the monocline (north of the Oder River) and the Sudety Mountains. Geothermal energy development can have a significant impact on district heating systems in many areas of Lower Silesia and can significantly contribute to achieving the goal of net zero emissions. The region also has good natural conditions for small and medium-sized hydroelectric power plants. However, due to their potential negative impact on biodiversity, developments in this respect are limited to their historical locations and existing hydrotechnical infrastructure.

An opportunity is also seen in obtaining electricity, heat and biogas from waste, including municipal waste. This would not only require an integrated system but also entail meeting the inherent challenges, which would be neither easy nor cheap. Recovering energy from waste by incineration, although also a means of minimising landfill, is only justifiable if the waste hierarchy is strictly adhered to (waste prevention, preparing for reuse, recycling, other recovery including energy recovery and disposal) and if emissions are minimised and as harmless to human life and health and the environment as possible.

As of 2020, the share of individual RES types relative to their total installed capacity in the Lower Silesian Voivodeship was as follows: 39.8% wind power plants (WI) — 176.4 MW; 17% hydropower plants (WO) — 75.2 MW; 13.4% photovoltaic (PV)

¹¹ DIRECTIVE (EU) 2018/2001 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 on the promotion of the use of energy from renewable sources

— 59.4 MW; 25.1% biomass power plants (BM) — 111.25 MW; 4.8% biogas power plants (BG) — 21.2 MW.¹² The share of renewable energy in total electricity generation in 2020 was as low as 10.2%.

Only through a systematic change of the fuel mix from high-carbon to zero-carbon does the possibility of public (EU) funding for investments open up, ultimately leading to lower electricity and heat prices for consumers. The "Report on the Condition of Lower Silesia's Energy Sector" also draws attention to the possibilities of using "community energy", which has a **positive impact on the development of regional and local energy sectors, enabling cooperation opportunities in energy production from renewable sources, activating society and enabling the achievement of economic goals, and all this in harmony with activities aimed at improving the quality of the environment.**

The basis for building energy communities, included in EU regulations and transposed into national law, is the **RED II Directive**,¹³ which emphasizes the importance of establishing and operating energy cooperatives. In Poland, two basic forms of cooperation in the field of community energy have been identified: **energy clusters**¹⁴ and **energy cooperatives**,¹⁵ which are a **mechanism of energy transition** based on decarbonisation, digitisation and decentralisation.

Energy clusters operate based on a civil law agreement, the parties to which may include natural persons, legal persons, scientific bodies, research institutes or local government units. Such agreements concern **energy generation and demand balancing or distribution and trading of energy from renewable energy sources or other fuel sources.** Energy clusters are intended to enable municipalities to achieve energy self-sufficiency.

The establishment of **energy clusters** generates the **following benefits at the local and regional levels:**

- increased energy security and regional competitiveness,
- reduction of the economy's energy intensity,
- creating new jobs;
- increasing the attractiveness of investment areas by reducing energy supply costs,
- stimulating economic development,
- increased accessibility and development of low-emission public transport,
- reducing emissions of harmful gases.

The **energy cooperative** regulations provide for discounts in settlements of the electricity generated and consumed by cooperative members, who have been assigned the **status of prosumers** by the above act. This type of energy community has been prioritised as an essential element of distributed generation and an example of decentralised community energy.

Analysis of activity in the formation of energy co-operatives in Poland reveals the following¹⁶:

- although energy clusters have not yet received support, their formation and development are dynamic, while energy cooperatives, which can, for example, enjoy discounts, are not being established;
- the development of energy communities is determined by social conditions — Poles have a negative view of cooperatives because these have so far been systemically weakened and liquidated, and are perceived as a relic of a centrally planned economy;
- the high activity of economic operators in creating cluster initiatives is due to the advantages offered by such networks and the dissemination of the idea of clustering.

While developing the "Report on the Condition of Lower Silesia's Energy Sector", a workshop was held, part of which was a survey addressed to Lower Silesian energy clusters. This made it possible to diagnose the barriers and problems limiting the development of this form of community energy cooperation, which is the most common today. Opportunities to reduce existing constraints were also identified, as well as institutions or the level of public administration responsible for supporting the resolution of individual problems.

The key constraints to the development of energy clusters currently relate to formal, legal and financial issues, in particular, restrictions in current legislation and the lack of appropriate regulations, as well as financial tools to support initiatives taken by clusters.

Recommendations for energy cluster development concern changes to existing legislation and the implementation of a coherent and streamlined financial support system that would effectively stimulate cluster initiatives. Most recommendations are addressed to national-level authorities responsible for formulating legal acts.

The European Union aspires to be a world leader in renewable energy promotion and development, setting the direction for efforts to combat negative climate change.¹⁷ This aspiration should include not only the goal of **transitioning to a low-carbon economy and stimulating high-potential economic growth** but also the **development of technologies** in this area through the supply of key components by European companies within and outside the Union.

Indeed, the very success of the energy transition depends on the development of innovation. Replacing hydrocarbons with RES requires far-reaching innovation, which is why the EU, through its legislation, wants to give the greatest possible impetus **to the search for breakthrough technologies.** The EU's policy **is to increase investments in energy efficiency and renewable energy technologies and to develop clean energy business models, taking advantage of new opportunities and considering the strong position of consumers due to digitisation.**

¹²Data from *the Analysis of production, consumption and demand for electricity, gaseous fuels and heat in the "Lower Silesia Energy Strategy — Directions of Support for the Energy Sector"*, Krajowa Agencja Poszanowania Energii SA, 2020

¹³ DIRECTIVE (EU) 2018/2001 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 on the promotion of the use of energy from renewable sources.

¹⁴ Act of 22 June 2016 on amending the Act on Renewable Energy Sources and Certain Other Acts (Dz.U. /Journal of Laws/ of 2016 item 925).

¹⁵ Act of 16 September 1982 — Cooperative Law (Dz.U. /Journal of Laws/ of 2020, item 275).

¹⁶ The conclusions were based on the findings of a workshop held by the IRT and the Lower Silesian Agency for Economic Cooperation as part of work on the "Report on the Condition of Lower Silesia's Energy Sector", among other things.

¹⁷ EC Communication 2016/767, Brussels, 23.2.2017. on the promotion of the use of energy from renewable sources.

The objective pursued by the Union¹⁸ is to **support the scientific and technological base by strengthening the European Research Area (ERA)**. The ERA will ensure the free movement of researchers, scientific knowledge and technology and increase its competitiveness while promoting all research and innovation activities.

The current challenge facing Poland is to adapt quickly to the new environmental requirements and the need to implement costly investment projects in the short term.

The events following Russia's invasion of Ukraine on 24 February 2022 revealed and amplified the threats to energy security associated with the geographical direction of the transfer of energy resources to Poland and, thus, to Lower Silesia. Dependence on fossil fuels must be recognised as one of the key weaknesses of the Polish economy. **The involvement of public actors at various levels in maintaining energy security is becoming a parallel and strategic challenge for regional development policy, in addition to counteracting negative climate change. The need to diversify energy sources, not only in terms of the geographical directions of supply but also in terms of how it is generated, takes on new value in this context. Paying attention to the endogenous power generation capabilities and production based on renewable sources is becoming one of the central pillars of this regional energy strategy.** As the region's administrator, the Local Government of the Lower Silesian Voivodeship recognises the need to support energy security efforts to ensure its proper long-term socio-economic development.

One of the national approaches to strengthening energy security is introducing nuclear power to replace the current coal-based energy system. In the environmental context, nuclear energy has a significant impact on reducing greenhouse gas emissions and decarbonising the energy sector.¹⁹ Notably, including nuclear technology in the taxonomy (which would enable EU financial support) is currently being debated.

Awareness of the consequences of climate change is the basis for taking and targeting action in all areas, especially in the

energy sector, which negatively affects greenhouse gas and air pollutant emissions in its current form.²⁰

The quality of the environment is crucial to the quality of life — our health, economy and prosperity. Europe faces major challenges, particularly related to climate change, unsustainable consumption and production, and various forms of environmental degradation. In September 2015, the UN General Assembly adopted the 2030 Agenda for Sustainable Development (2030 Agenda) containing **17 Sustainable Development Goals** and related targets. One of these is to urgently address climate change and its impacts (Goal 13) by improving education and human and institutional capacities, raising awareness of the effects of climate change and early warning systems for risks.

An indispensable element of the energy transition is effective environmental protection through the engagement of all citizens. The "2030 National Environmental Policy" indicates the need **to raise the level of environmental awareness and shape the environmental attitudes of society by promoting sustainable and balanced development.**²¹

Environmental education is a crucial part of education (from an early age) aimed at developing a society that accepts the interdisciplinary principles of sustainable national development, has the skills to assess the state of environmental security and to take action to improve it, as well as an awareness of the need to care for the common cultural and natural heritage.²² **Comprehensive environmental education** is part of the core curriculum of schools. The **"Development Strategy for Lower Silesia 2030"** indicates actions to support the shaping of pro-environmental **attitudes and environmental education based on local** resources (infrastructural, natural and cultural).

Due to the need to implement the so-called anti-smog resolutions, Lower Silesia's Local Government is striving to reach as many Lower Silesia residents as possible with the relevant information, and these activities are aimed at raising public awareness of the problem of air pollution and the restrictions and bans imposed by the new regulations. In this context, environmental education must also touch upon energy's impact on the environment and the health of society.

¹⁸ Regulation (EU) 2021/695 of the European Parliament and of the Council of 28 April 2021 establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination, and repealing Regulations (EU) No 1290/2013 and (EU) No 1291/2013.

¹⁹ "Polish Nuclear Power Programme" adopted by Council of Ministers Resolution No. 141 of 2 October 2020.

²⁰ IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C

above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D.

STRATEGIC OBJECTIVE

A CLIMATE-NEUTRAL LOWER SILESIA BY 2050

The strategic objective will be achieved through the implementation of operational objectives and is focused on reducing greenhouse gas emissions, primarily carbon dioxide (CO₂). The main instrument for achieving climate neutrality by

2050 is an energy transition based primarily on the decarbonisation of the energy sector, as well as its decentralisation and digitisation.

Climate neutrality is the balance between anthropogenic emissions of greenhouse gases and their removal by absorption through natural processes (oceans, seas, forests and soils).

Net zero emissions (net zero) means ensuring the balance between CO₂ emissions and the uptake of CO₂ from the atmosphere into the so-called carbon sinks.

MISSION OF LOWER SILESIA'S LOCAL GOVERNMENT

The Local Government of Lower Silesia:

- defines ambitious energy policy efforts resulting from the adopted strategic objective — a climate-neutral Lower Silesia by 2050,
- acts as a driver for change and innovation, raising awareness among the people of Lower Silesia and motivating them to take action,
- strengthens the position of the region in moving away from the use of fossil fuels for energy purposes,

- ensures consistency of Lower Silesia's policy with national objectives and policies resulting from European Union policies,
- specifies and supports the necessary actions to achieve climate neutrality.

The mission of Lower Silesia's Local Government has been defined based on the challenges associated with the need to transform the energy sector and provide access to energy from non-emitting sources for the development of an innovative economy.

VISION FOR THE FUNCTIONING OF THE REGION'S ENERGY SECTOR

As of 2050, Lower Silesia is a stable, energy-independent and self-sustainable region. Characterised by significant resilience to internal and external threats, it is simultaneously open to developing supra-regional network connections, including cross-border ones.

The target model for the functioning of the region's energy sector by 2030, as expressed in this Strategy, is consistent with the development scenario recommended in the Development Strategy for Lower Silesia 2030 and with the EU's 2030 targets adopted in this respect. It is assumed that:

- the local potential for RES development will be used in accordance with the identified potential of the voivodeship's individual areas (Figures 1–4, p.25–28 concerning RES (wind, sun, water, biogas) development potential in Lower Silesia); measures will also be implemented to counteract energy poverty (particularly noticeable during the energy transition); development of community energy and local energy communities (energy clusters, energy cooperatives and other forms of organisation used by local communities) will be supported and initiated;
- Lower Silesia's Local Government will initiate changes related to the energy transition and support the development of research and innovation in this field; due to the need to cut greenhouse gas emissions and increase the share of renewable energy sources and energy storage capacity, it will be necessary to support these processes through new technologies;

- funding under the Cohesion Policy, including the Fair Transition Fund, will support the main objective and indirectly mitigate possible negative social, economic and environmental impacts of the energy transition.

The vision for the functioning of the region's energy sector by 2050 is based on the designated EU policy orientations and primarily takes into account the achievement of the goal of climate neutrality. It assumes such things as:

- transitioning away from using fossil fuels in electricity generation and heating and cooling,
- reducing greenhouse gas emissions by 80–95% compared to 1990s levels,²³
- achieving a RES share of 70% in total energy production and 97% in electricity production,
- continuously improving energy efficiency in the construction, transport and energy sectors, and organising space to ensure a reduction in energy consumption,

²³ Brussels, 15.12.2011 COM(2011) 885 final, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL,

THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, Energy Roadmap 2050

- promoting electroprosumerism,

Electroprosumerism is a comprehensive approach to energy transition, which involves designing passive building systems (increased energy efficiency resulting in reduced energy demand), heating and transport electrification, and RES re-electrification (replacing all energy needs in construction, heating and transport with RES electricity).

- full electromobility or mobility based on zero-emission fuels,
- using RES electricity in all areas of economic activity and residential life,
- achieving energy supply security thanks to industrial energy storage technologies,
- using innovative technologies, including a 13–14% share of "green" hydrogen, in line with the EU Hydrogen Strategy.²⁴

The operational objectives recognise the need for an energy transition focused mainly on reducing greenhouse gas emissions and shifting away from the use of fossil fuels across all sectors of the economy. Energy transition aims to ensure a reliable and high-quality energy supply at socially acceptable prices. The implementation of all measures should be in line with the principle of sustainable development (respect for the environment, social progress and economic growth — UN 2030 Agenda). It is particularly vital to raise public awareness of this issue, as the energy transition affects both the technological and economic dimensions. The Local Government will play an important role in the responsible implementation of the energy transition.

The individual operational objectives overlap due to the strongly interrelated areas of action, which influence and complement each other. Groups of actions related to reducing the transport system's energy demand, protecting biodiversity and tackling energy poverty are included in several operational objectives and, due to their wide range of impacts, are a vital complement to them.

Lower Silesia's Local Government will implement **actions** to support the energy sector **until 2030 according to its competencies and management capabilities**. The energy transition will require actions taking into account the regional development policy, primarily regarding the impact on:

- **nature protection, in particular, conservation of biodiversity** (avoiding land degradation, afforestation, sustainable land management and planning);
- **spatial management, in particular, adequate planning of cities and infrastructure** (including transport and buildings);
- **energy security;**
- **economic development, in particular, support for technological innovation and increasing the energy efficiency of businesses;**

- **the development of human and social capital**, in particular, education, raising administrative and social awareness and responsibility, and fostering citizenship.

All actions will require compliance with **the principles of sustainable development and a redefinition of the understanding of development, which should not be construed as synonymous with an increase in consumption and purchasing power but with a sense of security and socio-economic balance, taking into account the value of the environment**.

Sustainable development "is development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

Report of the World Commission on Environment and Development, 1987

²⁴ Brussels, 8.7.2020, COM(2020) 301 final, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE

COMMITTEE OF THE REGIONS, A hydrogen strategy for a climate-neutral Europe.



Table 1. Overview of objectives and lines of action

STRATEGIC OBJECTIVE: A CLIMATE-NEUTRAL LOWER SILESIA BY 2050

targeted at measures related to the reduction of greenhouse gas emissions, primarily carbon dioxide (CO₂) — energy transition based on decarbonisation

THE TARGET MODEL FOR THE REGION'S ENERGY SECTOR BY 2030

is consistent with the development scenario recommended in the Development Strategy for Lower Silesia 2030 and with the EU's 2030 targets adopted in this respect.

THE VISION FOR THE FUNCTIONING OF THE REGION'S ENERGY SECTOR BY 2050

primarily takes into account the implementation of the goal of climate neutrality

OPERATIONAL OBJECTIVES

take into account the need for an energy transition based on reducing greenhouse gas emissions and shifting away from fossil fuels.

1.	2.	3.	4.	5.	6.	7.
AIR QUALITY IMPROVEMENT	DEVELOPMENT OF ENERGY RESEARCH AND INNOVATION	HIGH ENERGY EFFICIENCY	INCREASING THE USE OF RES AND ENERGY STORAGE TECHNOLOGIES	COMMUNITY ENERGY, INCLUDING PROSUMERS, CLUSTERS AND ENERGY COOPERATIVES	SAFETY	INFORMATION AND EDUCATION

LINES OF ACTION

<ul style="list-style-type: none"> reducing pollutant emissions resulting from energy generation processes, implementing the Air Protection Programme and the so-called anti-smog resolutions, supporting the shifting away from fossil fuels in heating, achieving the required air quality standards and increasing the quality of life. 	<ul style="list-style-type: none"> supporting research and innovation, striving to move away from hydrocarbon combustion, bolstering research in search of innovative technologies (e.g. based on hydrogen), developing energy storage technologies on an industrial scale, promoting trans-regional and international cooperation. 	<ul style="list-style-type: none"> supporting improvements in energy efficiency in: - energy processes, - buildings - enterprises, - transport, - organisation of space, promoting the use of intelligent technologies, including energy management and digitisation of the energy sector, implementing actions related to the tasks of the Local Government. 	<ul style="list-style-type: none"> promoting and supporting the use of renewable energy sources, taking into account the region's potential for the use of RES, supporting the development and modernisation of energy infrastructure, achieving energy supply security through support for the development and application of energy storage technologies. 	<ul style="list-style-type: none"> supporting active public participation in the energy transition and decarbonisation based on cooperation, developing distributed generation (community energy), promoting the establishment and operation of energy clusters and energy cooperatives — strengthening cooperation. 	<ul style="list-style-type: none"> supporting the diversification of energy sources with spatial planning instruments, conducting analyses to assess the scale of energy poverty in the region, supporting the diversification of energy supply routes and the creation of new international energy connections. 	<ul style="list-style-type: none"> raising public awareness of the need for change arising from the energy transition, promoting solutions to reduce global warming and improving air quality, adapting professional skills to the needs of the energy transition.
--	--	--	---	---	---	---

OPERATIONAL OBJECTIVE 1. AIR QUALITY IMPROVEMENT

Air quality is vital for human health and the environment, so measures to prevent and reduce emissions of pollutants that cause poor air condition are considered particularly important. It is crucial to identify and implement the most effective measures to reduce emissions of harmful compounds, as well as to set appropriate targets, standards and guidelines in this regard. The most troublesome air pollutants have been identified as coming mainly from energy generation (**primarily heat in the residential sector**), as well as transport and agricultural activities. EU regulations have introduced a formal basis for limiting emissions of combustion pollutants into the air, as well as requirements for the marketing and use of solid fuel heating sources.

National air pollution control programmes, as well as pollutant emissions and effects monitoring and information sharing in this area, are important tools for improving air quality. The assessment of air quality primarily serves to identify zones and urban areas where concentrations of pollutants in the air exceed limit values. **Air protection programmes** are developed for these areas to **plan remedial measures**.

An **air protection programme for Lower Silesia zones** along with a short-term action plan was adopted by the Lower Silesian Voivodeship Sejmik Resolution No. XXI/505/20 of 16 July 2020. It is based on a 2018 air quality diagnosis by the Chief Inspectorate of Environmental Protection's Regional Department of Environmental Monitoring in Wrocław, which indicates the following as the main sources harmful emissions to the air (in Lower Silesia zones) in 2018: **primarily emissions from household and municipal sector buildings, i.e. from household boiler rooms and furnaces, where high-emission fuels** (coal dust, brown coal, low-energy coal, wet biomass) **are used in old, low-efficiency heating systems**. Emissions limits are also exceeded **due to road transport**, mainly because of the use of emission-intensive combustion vehicles, increasing traffic congestion and low use of public transport, cycling and walking. **Planned corrective measures** include **reducing air emissions from household heating systems, expanding green space areas, environmental education and developing zero-emission and public transport**. Achieving the necessary transition in the transport sector requires a change in the current paradigm of infrastructure construction and redistribution of space for energy-efficient travel. It is necessary to create conditions that give a real advantage to zero-emission modes of transport, as well as to exploit the synergies of public transport coupling.²⁵

The Lower Silesian Voivodeship has introduced restrictions and bans on the operation of fuel-burning systems, the so-

called anti-smog resolutions, **which were adopted by the Lower Silesian Voivodeship Sejmik on 30 November 2017**. Due to varied local conditions, they apply to three areas of the province: Wrocław Municipality,²⁶ health resorts²⁷ and the remaining areas.²⁸ The adopted restrictions and bans apply to all users of solid-fuel heating systems with a capacity of up to 1 MW (boilers and solid-fuel furnaces and fireplaces). In particular, they set deadlines by which restrictions on using certain fuels and systems must be complied with. The regulations resulting from the anti-smog resolutions **banned the use of** the following substances starting from 1 July 2018: coal silt and flotation concentrates and mixtures produced using them; lignite coal and solid fuels produced using it; loose hard coal with a grain size of less than 3 mm (fine coal dust); solid biomass with an as-fired moisture content exceeding 20% (damp wood). Depending on the area, there are different cut-off dates for **banning the use of heating systems** which: were commissioned after 30 June 2018; do not comply with the emission standards corresponding to individual classes in terms of dust emission limits according to PN-EN 303-5:2012; are fuelled with solid fuels. The most restrictive rules concerning restrictions and bans, compared to the rest of the voivodeship, were imposed on Lower Silesian health resorts. This was due to specific environmental conditions and the risk of losing their health resort status if the beneficial properties of the local climate were not maintained.

The preparation and implementation of regional air protection programmes as part of assigned tasks and the so-called anti-smog resolutions are the responsibility of the voivodeship's local government. The proposed lines of action within the given operational objective are strongly linked to the implementation of the above documents and include reducing emissions resulting from energy generation processes. The actions in question serve to achieve the required air quality standards and improve the quality of life of Lower Silesia's residents.

Also of great importance for the achievement of the operational objective is the implementation of ²⁹a tool that assumes (in the context of individual heating) the replacement of emission-intensive heat sources and the complete abandonment of the use of coal for heating purposes in all residential buildings (by 2040, and in cities by 2030), as well as the phasing out of the use of natural gas in residential and non-residential buildings by 2050. At the same time, a transition of district heating towards low- and zero-emission sources should be pursued.

²⁵ *Conditions and Guidelines for Developing Zero-Emission Transport in Lower Silesia — Cycling Mobility in Daily Commuting of Lower Silesia's Residents*, IRT, Wrocław 2022

²⁶ Lower Silesian Voivodeship Sejmik Resolution No. XLI/1405/17 of 30 November 2017 on the introduction of restrictions and bans on the operation of fuel-burning systems in Wrocław Municipality

²⁷ Lower Silesian Voivodeship Sejmik Resolution No. XLI/1406/17 of 30 November 2017 on the introduction of restrictions and bans on the operation of fuel-burning systems in Lower Silesia's health resorts

²⁸ Lower Silesian Voivodeship Sejmik Resolution No. XLI/1407/17 of 30 November 2017 on the introduction of restrictions and bans on the operation of fuel-burning systems in Lower Silesia, excluding Wrocław Municipality and health resorts

²⁹ Long-term building renovation strategy. Supporting the renovation of the national building stock, Council of Ministers Resolution No. 23/2022 of 9 February 2022.

Lines of action under Operational Objective 1.

AIR QUALITY IMPROVEMENT:

- promoting the use of non-emitting energy carriers/sources, particularly renewable energy sources, in power generation processes;
- supporting the replacement of fossil fuels used in district heating with non-emitting sources;
- supporting the reduction of air pollutant emissions from individual heating — replacing low-stack emissions sources in facilities using solid-fuel boilers;
- preventing and reducing air pollutant emissions from heating systems in public facilities — replacing hydrocarbon-burning heat sources with non-emitting ones and converting district heating to non-emitting sources;
- supporting emission reductions in enterprises;
- financial support for the implementation of the so-called anti-smog resolutions;
- support for the development of low- and zero-emission public transport — aiming to power transport modes with RES energy (including the use of hydrogen);
- supporting the development of individual zero-emission mobility in daily traffic and its integration with energy-efficient public transport;³⁰
- financial support for the development of electromobility in local government units.

Supporting activities:

- raising awareness of the impact of air pollution on health and quality of life;
- support for improving forest conservation and expanding green space areas;
- synergy measures for the implementation of the Energy Strategy, the Air Protection Programme and the anti-smog resolutions.

³⁰As per Resolution No. 5437/VI/22 of the Management Board of the Lower Silesian Voivodeship on the adoption of *Conditions and Guidelines for Developing Zero-Emission Transport in Lower Silesia* —

Cycling Mobility in Daily Commuting of Lower Silesia's Residents of 1st June 2022.



OPERATIONAL OBJECTIVE 2. DEVELOPMENT OF RESEARCH AND INNOVATION

Tackling climate change is now the greatest civilisational challenge of the 21st century. Overcoming it **requires a change in the way we obtain energy**. Hydrocarbon combustion must be replaced by RES energy supported by other safe and non-emitting energy sources. This will only be possible by **developing completely new, disruptive energy technologies**. Launching an innovation programme in this area will enable Lower Silesia to become an energy transition leader. The new innovation strategy³¹ reaffirms the EU's commitment to setting an example in **preserving openness and international cooperation in research and innovation while promoting equal opportunities and reciprocity based on core values**. In addition, it reinforces the EU's leading role in supporting multi-stakeholder research and innovation partnerships aimed at finding new solutions to green, digital, healthcare and social challenges in particular.

The energy transition will be driven by energy R&D activities.

Thus, an increase in innovation across the Polish energy sector can be expected over the next few years. **The main objective is to phase out hydrocarbons and develop industrial-scale energy storage technologies.** Currently, hydrogen is the most promising energy source, including in terms of creating energy storage solutions. However, the production of hydrogen from water must not interfere with its use for domestic and household purposes. Given the possible increase in water demand, the rational management of water resources and the development of water retention systems must be considered. The EU hydrogen strategy entails the creation of innovative technologies by 2030, as well as a European Hydrogen System, which is to include "hydrogen valleys" adapted to specific regional conditions. **The success of the energy transition is therefore strongly dependent on the introduction of innovation and consideration of its impact on other sectors of the economy.**

Lines of action under Operational Objective 2.

DEVELOPMENT OF RESEARCH AND INNOVATION:

- bolstering pioneering research to find innovative technologies in the field of energy (e.g. the use of green hydrogen);
- financial support for R&D work (including technological improvements to existing solutions) carried out by enterprises (including start-ups), research organisations and scientific bodies, as well as technology implementation in such areas as:
 - energy efficiency, including in production processes,
 - RES development and energy storage,
 - electromobility,
 - carbon capture, storage and possible use;
- taking action and launching coordinated projects with other institutions distributing R&D funding;
- supporting the development and implementation of RES system production technologies utilising components that would enable them to be recycled and recovered at the end of their life in line with the principles of a circular economy;
- supporting the increased flexibility of energy systems and ensuring they can be integrated with RES, as well as enabling the use of new decarbonisation solutions (e.g. hydrogen-ready systems capable of using a mixture of natural gas and hydrogen);
- support for research into smart solutions that take into account the network-based cooperation of different energy generation solutions, including conventional, nuclear and RES-based technologies;
- improving the skills of employees involved in R&D and innovation;
- providing an attractive and stable workplace for researchers and innovators;
- promoting innovative collaborative solutions across sectors and scientific disciplines;
- taking account of supra-regional and international cooperation in conducting research and development;
- supporting the dissemination of new technologies and practices in the field of energy;
- organising advisory contact points for financing projects related to the development of research and innovation in the field of energy and providing professional and competent guidance.

Supporting activities:

- supporting initiatives related to innovative technologies and stimulating areas of creativity associated with the energy transition through the implementation of the Lower Silesian Innovation Strategy 2030;
- supporting the development of the hydrogen economy by exploiting the potential of the Lower Silesian Hydrogen Valley;
- carrying out a study to determine the region's total greenhouse gas emissions by economic sector and disseminating the complete data.

³¹ Regulation (EU) 2021/695 of the European Parliament and of the Council of 28 April 2021 establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination, and repealing Regulations (EU) No 1290/2013 and (EU) No 1291/2013 and Council Decision (EU)

2021/764 of 10 May 2021 establishing the Specific Programme implementing Horizon Europe – the Framework Programme for Research and Innovation, and repealing Decision 2013/743/EU.

OPERATIONAL OBJECTIVE 3. HIGH ENERGY EFFICIENCY

An important area of action to reduce greenhouse gas emissions is lowering the energy demand, which involves improving energy efficiency. Throughout the energy chain (generation, transmission, distribution and end use of energy), **increasing energy efficiency has a major impact on improving air quality and public health, reducing greenhouse gas emissions and improving energy security** (by reducing dependence on hydrocarbon imports from outside the European Union), as well as **lowering energy costs for users**. This objective is in line with the EU's commitments under the energy union, part of which is to treat energy efficiency as a fully-fledged energy source. A key element of the energy union is the principle of "energy efficiency first", which should be taken into account when defining new regulations on the energy supply and demand sides.

The EU-level energy efficiency target, expressed in terms of reduced primary or final energy consumption, is set at a **minimum of 32.5% by 2030**, taking into account that EU energy consumption by 2030 cannot exceed 1,273 Mtoe³² of primary energy or 956 Mtoe of final energy. This means **the EU needs to reduce primary energy consumption by 26% and final energy consumption by 20% compared to 2005**. EU documents emphasise the importance and necessity of regularly assessing progress towards the 2030 targets.

One must bear in mind that buildings, which account for approximately 40% of final energy consumption, **are of fundamental importance to the EU's energy efficiency policy**. It is recognised that improving the thermal performance of buildings will bring about a significant increase in energy efficiency which, in addition to enhancing energy independence, will create new jobs, particularly in small and medium-sized enterprises.³³ The tools implemented are intended to support the refurbishment of the residential and non-residential building stock (including public housing) and enable the cost-effective conversion of buildings to near-zero energy standards. According to the recommended scenario of the *"Long-term Building Renovation Strategy. Supporting the Renovation of the National Building Stock"*, the desired average annual rate of thermal efficiency improvement is approximately 3.8% (improvement to a primary energy demand (EP) index of no more than 50 kWh/(m² * year) — zero-emission buildings — is assumed as the predominant solution after 2035). It is expected that the process of achieving climate neutrality for Poland's building stock will be gradual due to economic efficiency and technical feasibility

reasons. The sequence of thermal efficiency improvement measures should be such as to bring the best possible effect in terms of reduced energy consumption and costs considering the resources involved.

The recommended refurbishment scenario will help to reduce primary and final energy consumption, contributing to Poland's energy savings assumed under the National Energy and Climate Plan (NECP) and thus to the Union's energy efficiency targets under Directive 2012/27/EU.

In addition, measures taken to improve energy efficiency also apply to transport and include strategies to promote public **transport**, energy-efficient vehicles, a shift from individual means of transport (cars) to walking, cycling and personal transporters, as well as land-use planning that reduces transport demand (e.g. appropriate shaping of the settlement network and organisation of the functional and spatial structure of buildings, including the prevention of building dispersal). The water and wastewater sector also plays a significant role in energy savings.

Given the projected increase in electricity, gas fuels and heat demand in the voivodeship and the anticipated further rise in energy and fuel prices, improving energy efficiency is a priority. Under current legislation,³⁴ the local government is obliged to apply energy efficiency measures and to take action to implement and finance energy efficiency projects. This includes taking steps to reduce energy consumption and environmental impact and lowering maintenance costs for facilities (including those owned by the LGU).

The actions should focus on **those related to spatial policy, bearing in mind that space is a limited resource** and that the way it is used can significantly increase energy consumption, particularly in the case of building dispersion and a dysfunctional spatial layout.

The definition of energy efficiency under current Polish legislation does not explain the concept quite precisely. In contrast, EU legislation defines it as the **ratio of output of performance, service, goods or energy, to input of energy**; this is further clarified in the Polish national definition by drawing attention to the need to consider comparable conditions of use and operation. **By contrast, energy efficiency improvement is an increase in energy efficiency as a result of technological, behavioural and/or economic changes**. This primarily involves reducing energy losses where possible.

³² Mtoe — millions of tonnes of oil equivalent

³³ Long-term building renovation strategy. Supporting the renovation of the national building stock, Council of Ministers Resolution No. 23/2022 of 9 February 2022.

³⁴ Act of 20 May 2016 On Energy Efficiency (consolidated text of Dz.U. /Journal of Laws/ of 2021, item 468, as amended)



Energy efficiency — the ratio between the achieved utility effect of a given facility, technical equipment or system under typical conditions of use or operation and the amount of energy consumed by that facility, technical equipment or system or as a result of the service necessary to achieve that effect.

Act of 20 May 2016 On Energy Efficiency (consolidated text of Dz.U. /Journal of Laws/ of 2021, item 468 as amended)

Lines of action under Operational Objective 3.

HIGH ENERGY EFFICIENCY:

- supporting energy efficiency improvements in the generation, transmission, distribution and end use of energy;
- improving the energy efficiency of buildings, including public buildings, involving all components and systems designed to reduce energy demand, particularly through thermal efficiency improvement;
- improving the energy efficiency of spaces — using planning tools, including regional planning documents (voivodeship spatial development plan) and local planning documents (land use plan, local spatial development plan) to introduce energy-demand-reducing spatial management principles through appropriate shaping of development functional and spatial layout, including the concentration of development near existing technical and communication infrastructure, supplementing the existing structure, creating compact development, as well as ensuring adequate access to services and railroads, roads and bicycle routes, including public transport;
- coordinating the development of settlement structures in connection with energy infrastructure systems (electricity, gas, district heating);
- supporting energy efficiency improvements in companies, supporting investment projects to reduce the negative impact of production processes and transport activities on the climate and environment and energy consumption (eco-innovation — saving resources in the production process, "clean" production, energy-efficient production, including the use of waste heat, travel optimisation, transport fleet modernisation, and other efforts);
- supporting energy efficiency improvements in historic buildings, where justified based on an assessment of the project's technical feasibility and economic viability;
- supporting energy efficiency improvements in transport, including by promoting energy-efficient low- and zero-emission vehicles, zero-emission transport (walking, cycling and personal transporters) ³⁵and public transport, and optimising the organisation of the public transport system;
- supporting energy efficiency improvements in the water, wastewater and waste sectors by using intelligent technologies and processes that reduce energy consumption and enable energy production;
- supporting energy sector digitisation, implementing smart energy management technologies and using them for forecasting.

³⁵As per the *Concept for Developing Zero-Emission Transport in Lower Silesia — Cycling Mobility in Daily Commuting of Lower Silesia's Residents*, Institute for Territorial Development (IRT), Wrocław 2022



OPERATIONAL OBJECTIVE 4. INCREASING THE USE OF RES AND ENERGY STORAGE TECHNOLOGIES

EU legislation is moving towards the elimination of hydrocarbons and the replacement of fossil fuels with renewable energy technologies. The use of RES is key to achieving a climate-neutral European Union by 2050. Regulations in this area are set out in EU and national documents. Climate neutrality can be achieved by promoting the transition to a low-carbon economy and stimulating economic growth based on high RES energy production potential. One of the European Commission's main priorities is for the EU to become a leader in renewable energy production. The ambition should not only be to make greater use of renewable energy sources but also to develop technologies in this area.

As such, there is growing interest in obtaining energy from renewable sources, which will make it possible to achieve the targets adopted in international agreements (increasing the share of renewable energy sources in the country's energy mix, decreasing prices of renewable energy, and increasing environmental awareness of the public). Hence, **the energy sector should be based on new technologies that enable the transition to a distributed energy system based on local energy production and consumption, energy storage, digitisation, sector coupling and electrification.**

Due to its location and terrain, the region has varied conditions for the development of **wind** and **solar** power as well as **biogas-based** energy (a technology using landfill gas, sewage sludge, as well as animal manure and waste from agri-food

Distributed generation is the generation of electricity, heat or cooling, or solid, liquid and gaseous fuels by smaller units or production facilities for local use.

processing). The Lower Silesian Voivodeship has favourable natural conditions for **small and medium-sized hydroelectric power plants** which, apart from producing energy, contribute to increasing water retention, preventing floods, maintaining

river beds, reconstructing and maintaining hydro-technical infrastructure, including historic hydroelectric facilities, and creating recreation sites.

Figures 1–4 showcase the conditions and potential for using renewable energy sources in Lower Silesia. They are based on the provisions and data contained in the Spatial Development Plan for Lower Silesia and the Study of Spatial Conditions for Wind Energy Development in Lower Silesia and its update, which made it possible to identify areas with the least potential constraints for RES facility development. The types of areas where establishing RES facilities is prohibited or otherwise not recommended are also detailed in the above documents.

The development of new business centres, like "hydrogen valleys", will require RES energy supply. **Such business areas will require not only an increased energy capacity but also the expansion of transmission networks and the construction of energy storage facilities to guarantee a continuous and stable energy supply.** Energy storage will be crucial for the large-scale use of renewables **due to RES output variability.** One **limitation in improving air quality** is that RES is only treated **as an alternative energy source** to hard coal, while it should be seen as the primary one. Efforts should be made **to eliminate biomass combustion** as a component of RES, except for biomass meeting the sustainability criterion (derived from waste). With the goal of **climate neutrality and a sustainable improvement in air quality**, it is necessary **to ensure the protection of biodiversity**, strive for **the restoration of damaged habitats**, and to **counter deforestation and the burning of dead trees.**

Ensuring **energy security and reducing negative environmental impacts** is possible by supporting the development of **a system based on regional and local energy sources together with energy storage solutions.** Notably, RES investment projects and their lead times are a major financial and organisational challenge for energy producers, distributors and service providers, as well as for emerging energy clusters, cooperatives and individual prosumers.

Lines of action under Operational Objective 4.

INCREASING THE USE OF RES AND ENERGY STORAGE TECHNOLOGIES

- supporting the replacement of hydrocarbon heat sources with renewable energy sources or connection to district heating systems powered by non-emitting sources;
- stimulating the development of distributed generation by exploiting Lower Silesia's potential for RES development, including wind, solar, hydro, shallow and deep geothermal energy solutions and biogas;
- to preserve the landscape and natural values and natural space, it is recommended to prevent the implementation of projects involving the production, storage and distribution of RES energy, which may have a significant impact on the environment, in areas set out in the relevant legislation,³⁶ as well as in the following areas:

³⁶ Act of 3 October 2008 on the Provision of Information on the Environment and its Protection, Public Participation in Environmental Protection, and Environmental Impact Assessment (consolidated text of Dz.U. /Journal of Laws/ of 2021, item 2373 as amended) and Act of 16 April 2004 on Nature Protection (consolidated text of Dz.U. /Journal

of Laws/ of 2020, item 55 as amended) and Act of 3 February 1995 on Protection of Agricultural and Forest Land (consolidated text of Dz.U. /Journal of Laws/ of 2021, item 1326 as amended) with respect to allocating land for non-agricultural and non-forest purposes

- areas identified in the Spatial Development Plan for Lower Silesia as proposed for legal protection and ecological corridors,
- priority landscapes resulting from the landscape audit for the Lower Silesian Voivodeship (currently under development),
- areas with high natural values which contribute to the preservation of biodiversity, as well as retain water and slow down its run-off;
- limiting support for the use of biomass for energy purposes, excluding waste biomass;
- supporting the development and deployment of energy storage technologies, including making use of the mining infrastructure of active and decommissioned mines;
- **contributing to the implementation of pumped storage projects, particularly the reduction of spatial conflicts, as well as social conflicts;**

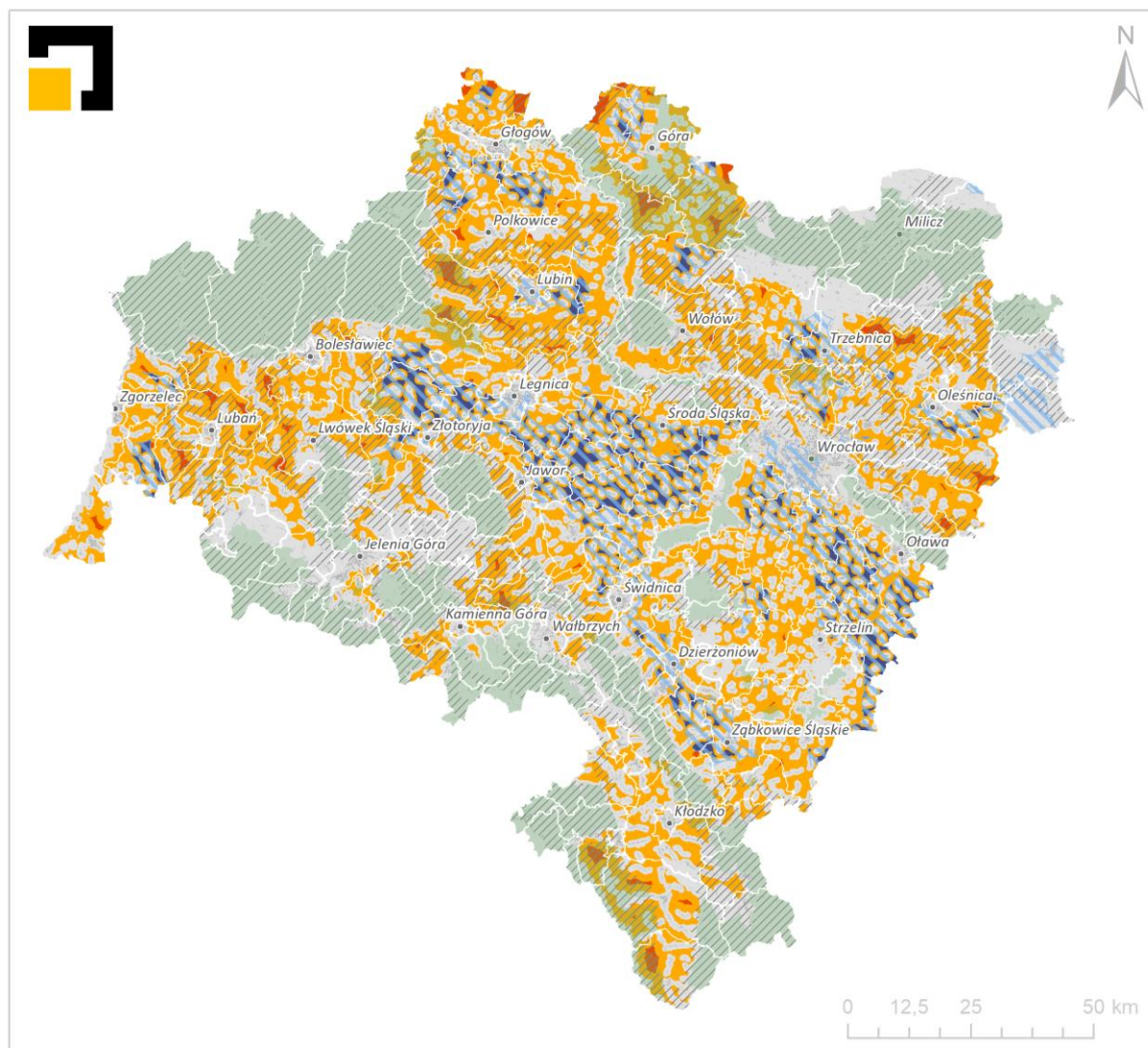
- employment support and up-skilling and re-skilling of the workforce in the field of production and use of RES and energy storage technologies (including the creation of teaching courses, profiling of schools, assessment and matching with labour market needs).

Support actions:

- maintaining (monitoring) a knowledge base on the development of renewable energy sources and the energy system in Lower Silesia;
- conducting scenario analyses of energy price relationships between different sources and technologies;
- analysing the area of Lower Silesia in terms of its potential for the development of various forms of RES energy generation and storage systems, together with the resulting implications (including the impact on the preservation of the cultural and natural landscape and availability and protection of valuable mineral deposits).


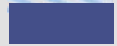




Figure 1. Wind energy development potential in Lower Silesia



Wind energy development potential

Areas suitable for wind power plant development, depending on their proximity to structures and nature conservation areas:



-  potentially least conflictive areas for wind power plant development*
-  potentially least conflictive areas for wind power plant development*, assuming a distance of 1000 m
-  areas suitable for wind power plant development under the current act** (minimum distance: 10H; the stated values apply to power plants with H=200)
-  areas suitable for wind power plant development under the draft act*** (minimum distance: 500 m)

* source: "Update of the Study of Spatial Conditions for Wind Energy Development in Lower Silesia"




** source: Act on Wind Power Plant Investment Projects (Dz. U. /Journal of Laws/ of 2021, item 468, as amended)

*** source: Draft Act on Amendments to the Act on Wind Power Plant Investment Projects and Certain Other Acts of 5 July 2022

Areas excluded and recommended for exclusion from wind power plant development

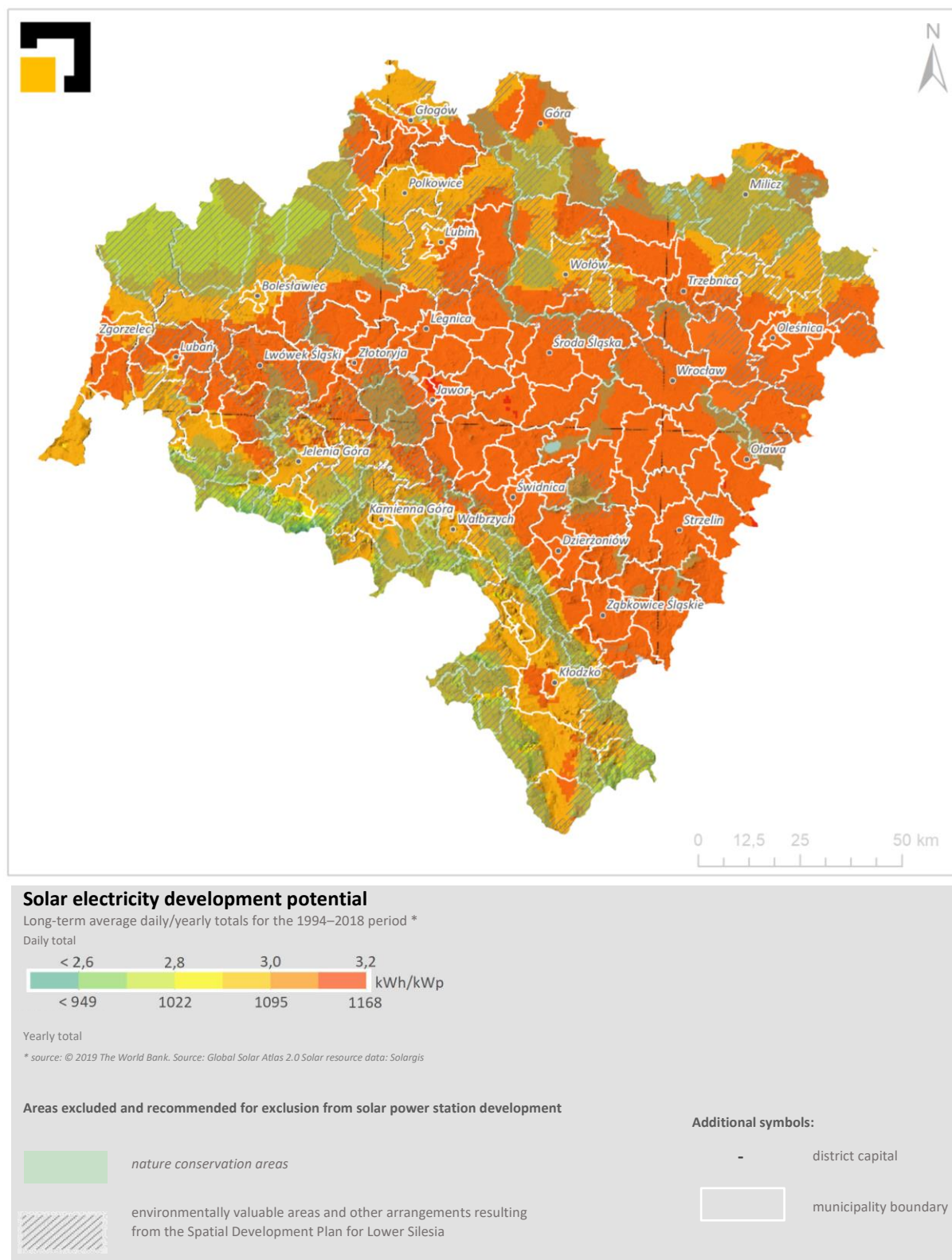
-  nature conservation areas
-  environmentally valuable areas and other arrangements resulting from the Spatial Development Plan for Lower Silesia

Additional symbols:

-  district capital
-  built-up area
-  municipality boundary

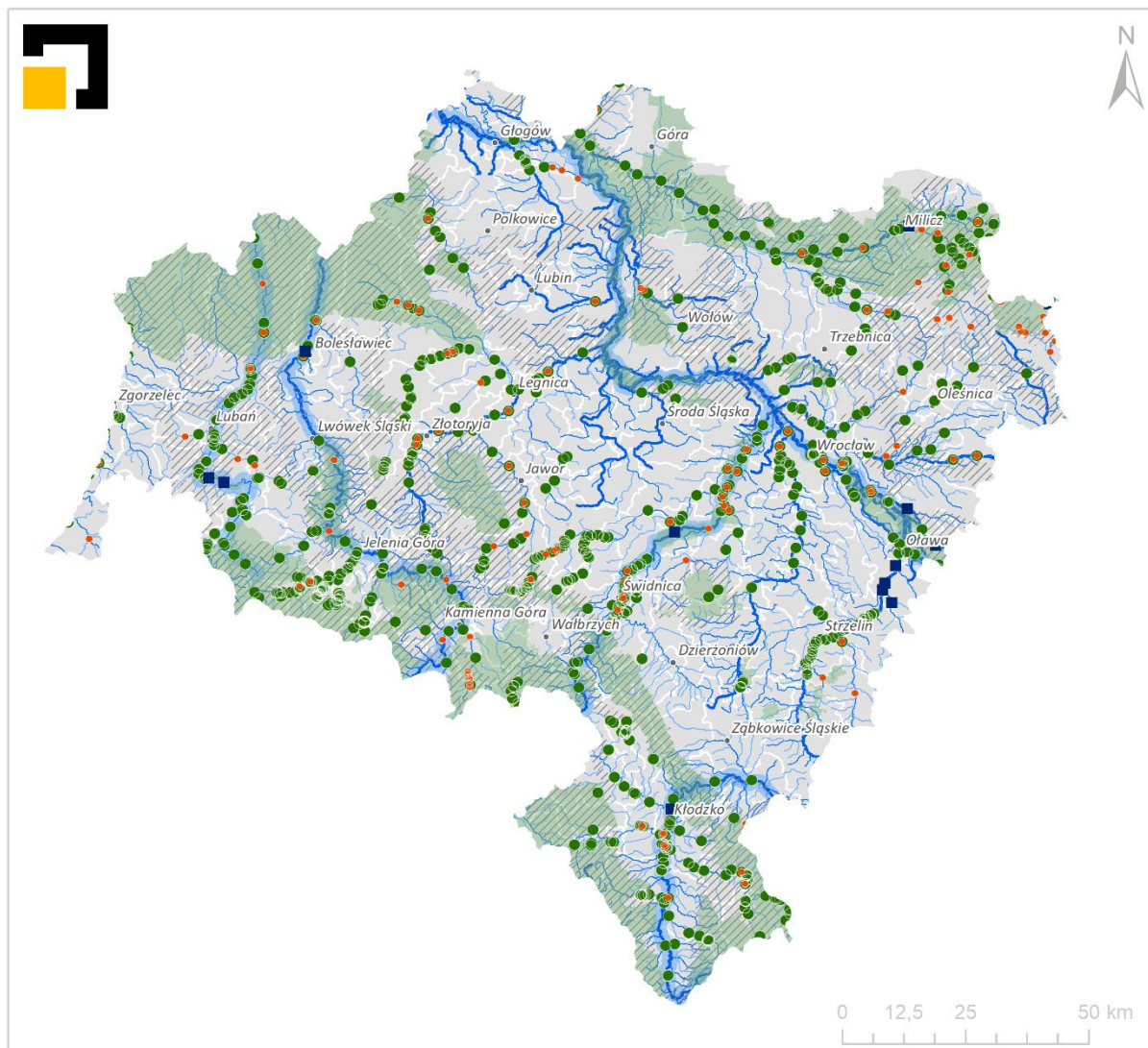
Source: IRT's elaboration

Figure 2. Solar electricity development potential in Lower Silesia



Source: IRT's elaboration

Figure 3. Hydropower development potential in Lower Silesia



Hydropower development potential

Technical condition of water facilities *

- active
- inactive
- requires reconstruction/modernisation

* data source: RESTOR Hydro, European Renewable Energy Federation

Rivers

- First-order
- Second-order
- Third-order
- Fourth-order
- with high theoretical hydropower potential

Areas excluded and recommended for exclusion from wind power plant development

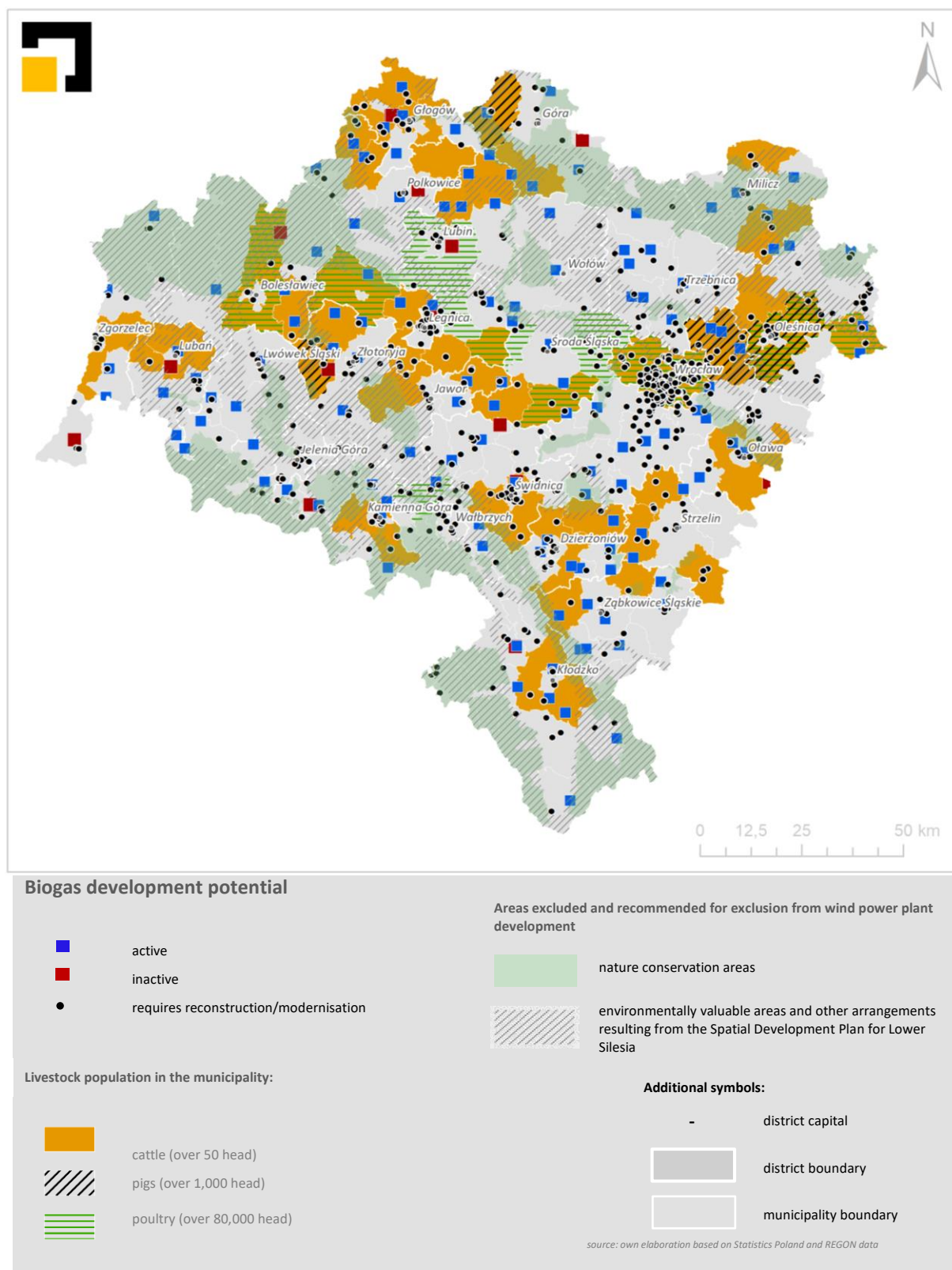
- nature conservation areas
- environmentally valuable areas and other arrangements resulting from the Spatial Development Plan for Lower Silesia

Additional symbols:

- district capital
- municipality boundary

Source: IRT's elaboration

Figure 4. Biogas development potential in Lower Silesia



Source: IRT's elaboration

OPERATIONAL OBJECTIVE 5. COMMUNITY ENERGY

Community energy is a system in which individuals, organisations, institutions and companies outside the energy sector are actively involved in energy generation and management. In practice, it consists in local, small-scale production of electricity and heat from renewable sources and reducing energy consumption through thermal efficiency improvements in buildings and businesses. Community energy is also about the participation of local communities in larger RES projects. Yet another aspect is building local alternatives to a centralised and big-business-dominated energy system.

"Energetyka obywatelska. Przewodnik dla samorządów po inwestycjach w energię odnawialną i efektywność energetyczną" — CEE Bankwatch Network, Warsaw 2015

Further, community energy is construed as involving citizens — directly or indirectly — in the development of distributed generation.

R. Mizieliński, "Energetyka rozproszona na świecie: modele funkcjonowania, regulacje, systemy wsparcia, wnioski dla Polski", Warsaw 2019

Action for a socially just and fair transition towards climate neutrality should be taken with the involvement and cooperation of all sections of society. To intensify this process, various stakeholders among local governments, academia, business and social partners should be involved on an international, national, regional and local level.

Community energy contributes to increasing the use of renewable energy and provides opportunities for co-generation, activating society and reducing energy costs, as well as improving environmental quality and the state of the climate. The basis for building energy communities is the RED II Directive,³⁷ which draws attention to the importance of the formation and operation of energy co-operatives. The provisions of this Directive are reflected in national legislation. The RED II Directive obliges Member States to ensure that energy communities have the right to: produce, consume, store and sell energy from renewable sources. Moreover, the Directive compels Member States to establish mechanisms for the promotion and development of energy communities at the national level and to deploy tools to facilitate their access to information and financing.

Two main forms of community energy interaction are identified in Polish legislation:³⁸ **energy clusters** and **energy cooperatives**. The creation of energy co-operatives aims to engage local communities in cooperation and renewable energy generation.

As civil-law arrangements, **energy clusters** are intended to increase energy security, create new jobs and boost the attractiveness of investment areas by reducing energy supply costs, stimulating economic development, as well as improving

the availability and development of low-carbon public transport and reducing greenhouse gas emissions. Lower Silesia has 7 certified energy clusters³⁹ whose key objectives and activities concern energy production, improving the quality of the environment (including the elimination of low-stack emissions), ensuring the optimal use of local energy potential and RES development, enhancing energy efficiency, creating innovative solutions in this area, as well as constructing energy distribution infrastructure and carrying out educational and promotional activities.

Self-balancing clusters, relying on a distribution network linking cluster participants, should play a special role.

A local energy cooperative may well be focused solely on ensuring the energy security of its members. Both energy cooperatives and energy clusters are local support mechanisms for renewable energy production, triggered as and when needed. In Lower Silesia, the emergence and development of energy clusters are far more dynamic than in the case of energy cooperatives. At present, the identified barriers to the development of energy clusters relate to formal, legal, financial and technical issues related to restrictions on the connection of new electricity-generating units.

Act of 20 February 2015 on Renewable Energy Sources introduced the concept of the "prosumer" — a portmanteau of **"producer"** and **"consumer"**, which denotes the final producer of electricity exclusively from renewable energy sources.⁴⁰ With the anticipated increase in electricity and heat prices posing an increasing challenge for energy and regulatory policies (support for an accelerated energy transition towards RES), as well as social policies (assistance for vulnerable

³⁷ DIRECTIVE (EU) 2018/2001 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 on the promotion of the use of energy from renewable sources

³⁸ Act of 20 May 2015 on Renewable Energy Sources (consolidated text of Dz.U. /Journal of Laws/ of 2021, item 610, as amended).

³⁹ The Pilot Energy Cluster Certificate was awarded to Sudety Autonomous Energy Region (ARES); Dzierżoniów Energy Cluster; Olawa Energy Cluster (EKO); Karkonosze Energy Cluster; South-Western Energy Cluster; Wałbrzych Energy Cluster; Zgorzelec

Renewable Energy Sources and Energy Efficiency Development Cluster (ZKlaster).

⁴⁰ A prosumer is an end-user who generates electricity exclusively from renewable energy sources for their own use in a micro-installation, provided that in the case of an end-user who is not a household consumer of electricity, this is not the subject of the predominant economic activity defined in accordance with regulations issued pursuant to Article 40(2) of the Act of 29 June 1995 on Official Statistics (Dz.U. /Journal of Laws/ of 2020, item 443).

consumers), this provides an opportunity for active energy consumers to make the most of opportunities to invest in their own energy sources (prosumerism).

It is also worth mentioning that the RED II Directive has introduced the concept of the **virtual prosumer**, defined as "a renewable energy prosumer operating in a group comprising at least two renewable energy prosumers acting jointly and located in the same building or multi-apartment building". The regulations introducing the concept of the virtual prosumer are intended to stimulate energy generation

in multi-family buildings (e.g. by housing cooperatives and communities) or administrative buildings, and the basic premise of the system is the joint operation of RES systems by prosumers.

The development of smart and flexible systems to manage energy demand and supply in a decentralised energy system based on renewable energy sources with an important role played by prosumers will be an important element of the future energy system.

Lines of action under Operational Objective 5.

COMMUNITY ENERGY, INCLUDING PROSUMERS, CLUSTERS AND ENERGY COOPERATIVES:

Regional-level support:

- supporting small entities, local bodies and NGOs/public benefit organisations in establishing energy communities;
- promoting and strengthening cooperation to secure the energy supply for areas with a high level of economic activity and intensive settlement development;
- supporting the creation and operation of self-balancing energy clusters based on local distribution networks linking cluster participants;
- preparing and launching subsidy tools, including reimbursements and the possibility of receiving bonuses or discounts for investments in RES-based energy sources and distributed cogeneration units;
- financial support for the educational activities of energy clusters;
- promoting and supporting the deployment of technologies driving the development of energy innovation and digitisation, particularly energy storage and hybrid units, using various solutions.

Support actions:

- financial support is sought for the adaptation of distribution networks to allow non-emitting generation sources to be connected to the grid;
- institutional support for energy clusters, e.g. by establishing a Lower Silesian Branch of the National Chamber of Energy Clusters or a Lower Silesian Chamber of Commerce of Energy Clusters, aimed at exchanging experience and know-how and strengthening cooperation between clusters.

OPERATIONAL OBJECTIVE 6. ENERGY SECURITY

Energy security is meant to provide a guaranteed energy supply (of electricity, heat and gaseous fuels) and is defined by a measure of the energy system's resilience to exceptional and unpredictable events that may threaten the physical integrity of energy flows or lead to an unstoppable increase in energy prices. It is therefore part of a national security system that ensures a constant and reliable energy supply, offered at a reasonable cost to society. It is also an essential part of any modern economy. Energy security is also a state of energy management that ensures the consumer's current and future fuel and energy needs are met in a technically and

economically feasible manner, with minimal adverse effects of the energy sector on the environment and the living conditions of society.

EU legislation has recognised "security" as fundamental to the functioning of the energy system.⁴¹ The new interconnections between Union countries are expected to enhance supply security and RES integration and increase competition in the internal market. Energy security was highlighted in the National Security Strategy of the Republic of Poland, approved in May 2020 by the President of the Republic of Poland.

Lines of action under Operational Objective 6.

ENERGY SECURITY:

- supporting the diversity of energy generation capacities in the region, including through spatial planning instruments (diversification of energy sources);
- supporting the increase in energy storage capacity in the region, including the implementation of pumped storage power plants;

⁴¹ 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.



- supporting the diversification of energy supply routes and the creation of new international energy connections;
- supporting the development and modernisation of energy systems;
- support the implementation of zero-carbon technologies that ensure energy security;
- supporting the continuity of energy supply and energy self-sufficiency for critical infrastructure necessary for the security of the region and citizens, including healthcare, transport, emergency services and water supply.

Supporting activities:

- existing electricity infrastructure, particularly transmission networks, should be used and maintained to increase the efficiency and security of the energy system;
- analyses should be carried out to assess the scale of energy poverty in the region, including in the context of the risk of rising energy prices and the acceptability of technological solutions introduced in the course of the energy transition (social security).

OPERATIONAL OBJECTIVE 7. INFORMATION AND EDUCATION

The basis for achieving climate neutrality by 2050 and implementing the energy transition is **raising public awareness and stakeholder engagement**. To this end, it is necessary to ensure public participation in decision-making processes and to guarantee full access to information in line with the principles of sustainable development. Indeed, the active involvement of all social groups in development processes is conducive to finding sustainable and acceptable solutions to guarantee socio-economic development.

Improving the creation and dissemination of knowledge bases and best practices is also of particular importance in this process. Increasing climate and environmental knowledge requires the support of the public and stakeholders, as well as promoting knowledge on sustainability and new models of sustainable consumption. Full knowledge and awareness of the problems arising from the energy transition (e.g. temporary increases in energy prices) will help gain public acceptance, which is crucial in achieving climate neutrality by 2050.

It must be stressed that the energy transition process is also linked to the creation of new jobs, particularly at SMEs. It is therefore necessary to mobilise **support for skills development and training in the energy sector**, particularly in terms of using technologies that improve energy efficiency.

Enabling citizens and consumers to become active participants in the transition is also intended to give energy-poor households easier access to energy-efficient buildings and more affordable RES-based energy sources. One of the goals of the European Green Deal is to help EU countries tackle energy poverty. The National Energy and Climate Plan for the years 2021-2030 provides dedicated energy efficiency instruments and measures that include actions targeting energy-poor households. In contrast, the Energy Policy of Poland until 2040 estimates that the widespread thermal efficiency improvement of residential buildings and the provision of efficient and environmentally friendly heating will have an impact on reducing energy poverty. Available data⁴² shows that the **rate of energy poverty** in Lower Silesia's single-family households in 2016 was **12.4% (35,113 households)**. The problem in question mainly affects either single-person households or those with 5 or more people. The largest group of people affected by energy poverty in the region are pensioners, and the scale of the problem is compounded by the high proportion of unmodernised pre-1945 buildings. Directing awareness-raising and support measures to this group of voivodeship residents is a major challenge.

Lines of action under Operational Objective 7.

INFORMATION AND EDUCATION:

- conducting information and education activities on energy, in particular, to promote RES;
- developing a network of counselling centres and providing training for counsellors (as part of an educational campaign run by the voivodeship's local government);
- raising awareness of energy efficiency and the operation of RES-based energy sources and communicating opportunities for the use of new technologies;
- informing residents of the possibility of obtaining subsidies and taking advantage of financial programmes to mitigate the impact of the energy transition, as well as of the need to commit their own financial resources to emission reduction and climate change mitigation and adaptation;
- raising awareness of the irreversible dangers of global warming resulting from excessive greenhouse gas emissions;
- promoting a sustainable consumption model;
- promoting the development of businesses based on a circular economy model;
- informing residents about the impact of air quality on their health and implementing anti-smog resolutions;
- supporting activities related to afforestation, as well as conservation and protection of forests, soils and other ecosystems — activities improving biodiversity, with a focus on threats to food security;
- developing a mechanism to identify energy-poor households;
- promoting best practices to inspire the public and stimulate citizens' creativity and responsibility;
- cooperating at all levels (national and regional authorities, the public, scientific institutions and private companies) to amplify the global response to climate change.

Climate change mitigation is the prevention or reduction of greenhouse gas emissions and associated climate change.

Climate change adaptation is the process of adapting to actual and expected climate change and its impacts.

⁴² P. Lewandowski, A. Kielczewska, K. Ziółkowska, Zjawisko ubóstwa energetycznego w Polsce, w tym ze szczególnym uwzględnieniem zamieszkujących w domach jednorodzinnych, IBS Research Report 02/2018

RECOMMENDATIONS AND REQUESTS

ADDRESSED TO THE POLISH GOVERNMENT

A priority request is to make clear decisions on Poland's achievement of climate neutrality by 2050 and phasing out fossil fuels, which must be backed up by appropriate legal regulations and financing tools.

We call for:

- rational planning of long-term energy policy, preventing its frequent updating, while simultaneously setting bold targets for the energy transition (phasing out hydrocarbons for climate and energy security reasons),
 - a long-term national energy policy that is consistent with and further elaborates the provisions of the National Energy and Climate Plan,
 - Providing stable, comprehensible and unambiguous legislation and developing optimised procedures for:
 - spatial planning at all levels to increase energy security and efficiency;
 - investment projects related to increasing the flexibility of energy systems and ensuring their integration with RES-based energy sources;
 - investment projects enabling the use of new decarbonisation solutions.
 - accelerating decarbonisation by ensuring the diversification of natural gas supplies as an interim energy source while boosting the development of RES technologies,
 - involving local government units in the implementation of the national energy policy by providing the legal powers and financial instruments necessary for the energy transition process,
 - providing public funding for climate change adaptation and mitigation investment projects.
- reducing regulatory barriers, providing technical assistance, direct grants and loan schemes for energy efficiency measures,
 - implementing the *"Long-term Building Renovation Strategy. Supporting the Renovation of the National Building Stock"* project, which aims to achieve an improvement in the energy efficiency of the construction sector through a comprehensive renovation of the building stock in Poland, with ambitious targets set,
 - supporting the development of high-efficiency cogeneration and system heat based on non-emitting sources,
 - supplementing the definition of energy efficiency in the current legislation concerning the shaping of settlement structures by means of an appropriate spatial policy,
 - introducing appropriate regulations that would require planning documents to include provisions on concentrating development projects within the range of the existing technical infrastructure networks, creating compact development, ensuring adequate access to services and optimising land management by providing access to railroads, roads and bicycle routes (including public transport),
 - accelerating the rate of thermal efficiency improvements by operating a beneficial support system and an appropriate credit scheme.

The actions recommended for the central administration under Objective 1 are a supporting element for the regional authorities. The Polish government must support regional and local authorities in terms of:

- providing public funding for climate change adaptation and mitigation investment projects, including zero-emissions mobility,
- using risk-reducing instruments for low-carbon and adaptation investment projects through appropriate government policies and encouraging the mobilisation of financial resources,
- local government funding for electromobility (e.g. charging/refuelling infrastructure, zero-emissions vehicles).

Actions recommended for the central administration under Objective 2:

- adopting effective innovation policies that combine public support for R&D with policies that encourage technology diffusion.

Actions recommended for the central administration under Objective 3:

Actions recommended for the central administration under Objective 4:

- providing financial support for the long-term development of zero-emissions energy based on renewable energy sources,
- streamlining the regulations on selecting the sites for renewable energy sources while respecting environmental resources and preserving biodiversity,
- introducing regulations to allow simultaneous agricultural production and renewable energy generation on agricultural land (without having to change its use classification to non-agricultural),
- supporting the energy autonomy of regions, construed as the ability to self-stabilise.

Actions recommended for the central administration under Objective 5:

- promoting and strengthening prosumerism (community energy),
- developing a system of incentives and facilitators, including fiscal instruments to support the energy transition and mobilise those involved in creating a distributed energy system (including energy clusters),
- developing an unambiguous financial, legal, technical and organisational framework for community energy,
- removing territorial restrictions (administrative boundaries) regarding the areas of operation of energy clusters.

Actions recommended for the central administration under Objective 6:

- developing crisis scenarios (considering things like military threats, economic consequences, etc.) to strengthen the energy security of Poland's regions, including Lower Silesia, and to make them more resilient to threats,
- establishing a state policy on energy raw material deposits and introducing legal protection for prospective and projected areas of strategic mineral deposits.

Actions recommended for the central administration under Objective 7:

- promoting a sustainable consumption model,
- raising citizens' awareness of the need to commit their own financial resources to emission reduction, as well as climate change mitigation and adaptation efforts,
- introducing a transparent and comprehensible message to citizens about the energy costs incurred from the perspective of the individual end user (transparent billing),
- clarifying the definition of energy poverty⁴³ and adopting metrics for its definition in national legislation,
- creating a comprehensive state policy to address energy poverty,
- introducing the subject of energy efficiency into the education curricula with individual and systemic solutions in the fields of environmental protection, spatial planning, transport, housing, industry and services.

ADDRESSED TO LOCAL GOVERNMENTS

The energy transition and achieving climate neutrality should be fundamental priorities at the local level.

We call for:

- promoting, supporting and expanding subsidies for environmental programmes and investment projects, particularly those related to the energy transition, including energy production and storage,
- taking more extensive measures to work with NGOs, which can provide more support for the activities of local authorities and thus influence the building of civil society,
- cooperation between local governments in air quality improvement programmes,
- a spatial policy based on the energy balance of municipalities and the individual settlements, with particular emphasis on energy supply and the energy costs of transport services for these areas,
- using planning tools to prevent building dispersal and structural and spatial arrangements that generate increased energy demand,
- reducing energy demand through sound spatial management, accounting for efficient planning of settlement structures, transport, green and blue infrastructure environmental resources and the regeneration of degraded areas,
- developing municipal long-term building renovation strategies based on the Long-term Building Renovation Strategy guidelines, which would form the basis for updating and integrating low-carbon management plans, assumptions for heat, electricity and gas fuel supply plans and local planning studies and decisions,
- taking measures to improve the competitiveness of public transport, walking and cycling, which contribute to lower energy consumption,
- involving all local government units in efforts to achieve energy transition goals.

⁴³ Art. 5gb.1. the Act of 17 December 2021 on the Inflation Allowance (Dz.U. /Journal of Laws/ of 2022, item 1 as amended)

IMPLEMENTATION AND FINANCIAL FRAMEWORK

The Energy Strategy's implementation is one of the phases of integrated strategic management and will be implemented based on the following principles:

1. **Sustainability Principle** — meeting the needs of the present without compromising the ability of future generations to meet their own needs.
2. **Electroprosumerism Principle** — designing passive building systems, heating and transport electrification, and RES re-electrification.
3. **Energy Efficiency Principle** — considering the "Energy Efficiency First" rule when defining new energy supply and demand regulations.
4. **R&D-Driven Modern Technology Use and Development Principle** — enabling an increase in energy innovation over the next few years
5. **Economic and Transport Competitiveness Principle** — making products and services more attractive by increasing the importance of manufacturing them using renewable energy sources, improving energy efficiency and applying the principles of a circular economy.
6. **Cooperation Principle** — taking action for a socially just and fair energy transition, with the involvement and collaboration of all segments of society.
7. **Climate Crisis Awareness Principle** — preventing and reducing emissions to avoid a climate catastrophe and to adopt adequate civic attitudes accordingly.
8. **Energy Security Principle** — ensuring that social and economic energy needs are met at a socially reasonable price while minimising negative environmental impacts.
9. **Spatial Integrity Principle** — treating space as a valuable and limited commodity. The Spatial Integrity Principle aims to preserve spatial order,⁴⁴ protect the landscape, secure and protect valuable natural resources and safeguard mineral deposits, whether confirmed, prospective or projected.

Achieving the goals set out in the document (**air quality improvement, developing energy research and innovation, high energy efficiency, developing renewable energy sources and energy storage technologies, supporting community energy, energy security, raising awareness and shaping attitudes**) will be made possible thanks to such financial instruments as:

- **European Funds for Lower Silesia 2021-2027** (FEDS 2021-2027).
- Under the EU's 2021-2027 perspective, EU and national

funds will support innovation, entrepreneurship, digitisation, infrastructure, environment, energy, education and social affairs. The Strategy's objectives fit predominantly into the FEDS priority areas of action outlined below:

- enhancing R&D potential (Developing and strengthening research and innovation capacities and the use of advanced technologies, CP1, i),
- regional smart specialisations (Developing skills for smart specialisation, industrial transition and entrepreneurship, CP1, iv),
- energy efficiency (Promoting energy efficiency and reducing greenhouse gas emissions, CP2, i),
- Renewable energy (Promoting renewable energy in accordance with Directive (EU) 2018/200, including its sustainability criteria, CP2 ii),
- urban and metropolitan area mobility (Supporting sustainable multimodal urban mobility as part of the transition towards a zero-emissions economy, CP2, viii),
- Social, economic and environmental transition (Enabling regions and populations to mitigate the social, employment, economic and environmental impacts of the transition towards achieving the Union's 2030 energy and climate goals and towards a climate-neutral Union by 2050 under the Paris Agreement, CP6 and FST);

- **Budget of the Lower Silesian Voivodeship;**
- **dedicated national and international programmes and projects;**
- **other.**

The following stakeholders, in particular, may be involved in implementing Lower Silesia's energy strategy:

- Management Board of the Lower Silesian Voivodeship and its subordinate local government units and institutions,
- energy companies,
- energy clusters and cooperatives.

Further, the Strategy's implementation may also engage:

- government administration bodies,
- local government units,
- higher education and R&D bodies,
- entrepreneurs,
- NGOs,
- and other private actors and individuals.

⁴⁴ Article 2 of the Act of 27 March 2003 on Spatial Planning and Land Development (consolidated text of Dz.U. /Journal of Laws/ of 2022, item 503 as amended).

EVALUATION OF THE STRATEGY'S ALIGNMENT WITH EU, NATIONAL AND REGIONAL STRATEGIC DOCUMENTS

The table below illustrates how the objectives of Lower Silesia's Energy Strategy correspond to those of documents guiding development policy at the international, EU, national and regional levels. The principle that any newly developed

document must be integrated into existing regulations and that any further iteration of those already adopted must refer to previous results is hereby fulfilled.

Table 2. Evaluation of the Strategy's alignment with EU, national and regional strategic documents.

Item	EU AND INTERNATIONAL STRATEGY DOCUMENTS	MAIN OBJECTIVE OF THE DOCUMENT
1.	Communication From the Commission, COM(2016) 860 final, "Clean Energy for all Europeans"	<ol style="list-style-type: none"> 1. Energy Efficiency First 2. World leader in renewable energy 3. Fair treatment of consumers
2.	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	<ol style="list-style-type: none"> 1. Implementing strategies and measures to meet the assumptions and targets of the Energy Union and to fulfil the Union's long-term commitments to reduce greenhouse gas emissions under the Paris Agreement and in the first ten-year period between 2021 and 2030, particularly to achieve the Union's 2030 energy and climate goals; 2. Stimulating cooperation between Member States, including at the regional level where appropriate, to achieve the objectives and targets of the Energy Union; 3. Ensuring timely, transparent, accurate, consistent, comparable and complete reporting by the Union and its Member States to the Secretariat of the UNFCCC and the Paris Agreement; 4. Contributing to greater regulatory and investor certainty and taking full advantage of opportunities for economic development, stimulating investment, job creation and social cohesion.
3.	Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources	Promoting the use of renewable energy
4.	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	<p>Transforming the EU into a fair and prosperous society living in a modern, resource-efficient and competitive economy with zero net greenhouse gas emissions by 2050 and where economic growth is decoupled from the use of natural resources.</p> <p>Protecting, preserving and enhancing the EU's natural capital and protecting the health and well-being of citizens from environmental risks and negative impacts.</p>
5.	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	Achieving a more ambitious EU emissions reduction target for the benefit of all Europeans and creating opportunities to participate in the transition, providing assistance to those most in need and achieving higher overall emissions reductions.
6.	Regulation (EU) 2021/1056 of the European Parliament and of the Council of 24 June 2021 establishing the Just Transition Fund	Mitigating the negative impacts of climate transformation by supporting the most affected territories and workers and promoting a balanced socio-economic transition.
7.	2030 Agenda for Sustainable Development, adopted by United Nations (UN) countries in 2015.	<p>Sustainable Development Goals:</p> <p>Goal 7. Affordable and Clean Energy</p> <p>Goal 9. Industry, Innovation and Infrastructure</p> <p>Goal 13. Climate Action</p>
Item	NATIONAL STRATEGY DOCUMENTS	MAIN OBJECTIVE OF THE DOCUMENT
1.	National Energy and Climate Plan for the years 2021-2030	<ol style="list-style-type: none"> 1. Reducing emissions 2. Energy efficiency 3. Energy security 4. Internal energy market 5. Research, innovation and competitiveness
2.	Energy Policy of Poland until 2040	The objective of the national energy policy is to achieve energy security while ensuring economic competitiveness and energy efficiency, as well as reducing the environmental impact of the energy sector and making optimum use of the country's energy resources.
3.	Principles for the update of the Energy Policy of Poland until 2040	Enhancing energy security and independence
4.	National Recovery and Resilience Plan	<p>Strategic objective</p> <p>Reduce the economy's negative environmental impact while ensuring Poland's competitiveness and energy and environmental security.</p> <p>Specific objective B1. Increasing energy efficiency of the economy.</p> <p>Specific objective B2. Increasing the use of renewable energy sources.</p> <p>Specific objective B3. Adapting to climate change and reducing environmental degradation.</p>
Item	LOWER SILESIA'S STRATEGIC DOCUMENTS	MAIN OBJECTIVE OF THE DOCUMENT
1.	Development Strategy for Lower Silesia 2030	Harmonious development of the region and high quality of life for Lower Silesia residents



2.	Spatial Development Plan for Lower Silesia (Lower Silesian Voivodeship Sejmik Resolution No. XIX/482/20 of 16 June 2020)	Lower Silesia 2030: Different Areas — One Region; Different Potentials — Coherent Development
3.	Lower Silesian Innovation Strategy 2030 (Resolution No. 3270/VI/21 of the Management Board of the Lower Silesian Voivodeship)	Strategic Objective 1. Increasing the role of innovation in the regional economy. Strategic Objective 2. Enhancing cooperation between the actors of the Lower Silesian Innovation System. Strategic Objective 3. Internationalisation of the Lower Silesian Innovation System. Strategic Objective 4. Reinforcing pro-innovation skills and attitudes.
4.	Anti-smog resolutions: 1. Lower Silesian Voivodeship Sejmik Resolution No. XLI/1405/17 of 30 November 2017 on the introduction of restrictions and bans on the operation of fuel-burning systems in Wrocław Municipality; 2. Lower Silesian Voivodeship Sejmik Resolution No. XLI/1406/17 of 30 November 2017 on the introduction of restrictions and bans on the operation of fuel-burning systems in Lower Silesia's health resorts; 3. Lower Silesian Voivodeship Sejmik Resolution No. XLI/1407/17 of 30 November 2017 on the introduction of restrictions and bans on the operation of fuel-burning systems in Lower Silesia, excluding Wrocław Municipality and health resorts.	Preventing negative impacts on human health and the environment.
5.	Air protection programme for Lower Silesia areas where the permissible and target levels of substances in the air were exceeded in 2018, accompanied by a short-term action plan. LOWER SILESIA VOIVODESHIP SEJMIK RESOLUTION No. XXI/505/20 of 16 June 2020 on the adoption of an air protection programme for Lower Silesia areas where the permissible and target levels of substances in the air were exceeded in 2018, accompanied by a short-term action plan.	Improving air quality to protect human health.
6.	TERRITORIAL JUST TRANSITION PLAN OF THE LOWER SILESIA VOIVODESHIP 2021-2030 WAŁBRZYCH SUB-REGION	A Wałbrzych sub-region without coal. Involved in the pursuit of secure and stable socio-economic development for climate neutrality, skill improvements and a better quality of life
7.	TERRITORIAL JUST TRANSITION PLAN OF THE LOWER SILESIA VOIVODESHIP 2021-2030 ZGORZELEC DISTRICT	After the transition, Zgorzelec District and the borderland will be an attractive place to live, rest, recreate and work considering the location, environment and technological development, as well as its connection and integration with the international environment. At the same time, it will effectively meet the needs of the inhabitants thanks to their engagement and intellectual potential and the high organisational efficiency of the local government units.

An analysis of the alignment of objectives listed in the above documents indicates the following:

- this document **is in line** with the objectives and lines of action set out in the strategic documents on reducing negative impacts on human health and the environment (improving air quality), supporting research and innovation and strengthening cooperation in this area, promoting and supporting the development of RES and community energy, education and information (including changing or improving staff qualifications);
- all lines of action proposed in the Energy Strategy will contribute to the objectives of the strategic documents;
- as the "Development Strategy for Lower Silesia 2030" was prepared before the "National Energy and Climate Plan for the years 2021-2030" was drafted and submitted to the European Commission, issues concerning the use of conventional energy potential were included. However, phasing out fossil fuels for energy purposes is necessary to meet the strategic goal of achieving climate neutrality by 2050;
- due to the significant increase in gas prices and its limited accessibility, as presented in the "Spatial Development Plan for Lower Silesia", further expansion of the network may prove problematic at present.

MONITORING AND EVALUATION

Measures implemented based on the designated directions of support for the energy sector should contribute to Lower Silesia's energy transition. The extent, pace and dynamics of this transition will be determined by ongoing monitoring based on such things as data characterising the energy market, energy production and consumption volumes and CO₂ emissions. It is assumed that baseline data, precisely defining the situation in the region, will be obtained based on the studies and analyses recommended in this document.

The key indicators for assessing the changing situation in Lower Silesia's energy sector are:

- electricity production by source;
- electricity consumption by sector;
- power plant installed power and generating capacity;
- share of renewable energy sources in gross final energy consumption;
- total CO₂ emissions, including by sector;
- prosumer systems power output.

Obtaining data from the list of the above metrics and their annual updates will allow energy transition trends to be examined and the feasibility of a climate-neutral Lower Silesia by 2050 to be determined.



REFERENCES

1. 2030 Agenda for Sustainable Development; UN, 2015,
2. Lower Silesian Innovation Strategy, Resolution No. 3270/VI/21 of the Management Board of the Lower Silesian Voivodeship of 5 January 2021,
3. DIRECTIVE (EU) 2018/2001 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 on the promotion of the use of energy from renewable sources,
4. European Funds for Lower Silesia 2021-2027 (FEDS) — Draft,
5. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Energy Roadmap 2050, COM/2011/0885 final, Brussels, 15.12.2011,
6. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, A hydrogen strategy for a climate-neutral Europe, COM(2020) 301 final, Brussels, 8.7.2020,
7. 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,
8. 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,
9. Communication From the Commission, "Clean Energy for all Europeans", COM(2016) 860 final,
10. Concept for Developing Zero-Emission Transport in Lower Silesia — Cycling Mobility in Daily Commuting of Lower Silesia's Residents, Institute for Territorial Development (IRT), Wrocław 2022,
11. National Energy and Climate Plan for the years 2021-2030, Ministry of State Assets,
12. National Recovery and Resilience Plan, 2022,
13. Spatial Development Plan for Lower Silesia, Lower Silesian Voivodeship Sejmik Resolution No. XIX/482/20 of 16 June 2020,
14. Energy Policy of Poland until 2040, Notice of the Minister of Climate and Environment of 2 March 2021 (item 264),
15. Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty; IPCC, 2018 [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)],
16. Air protection programme for Lower Silesia areas where the permissible and target levels of substances in the air were exceeded in 2018, accompanied by a short-term action plan,
17. 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'),
18. Regulation (EU) 2021/1056 of the European Parliament and of the Council of 24 June 2021 establishing the Just Transition Fund,
19. 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,
20. Regulation (EU) 2021/1056 of the European Parliament and of the Council of 24 June 2021 establishing the Just Transition Fund,
21. Development Strategy for Lower Silesia 2030, Lower Silesian Voivodeship Sejmik Resolution No. L/1790/18 of 20 September 2018,
22. Territorial Just Transition Plan of the Lower Silesian Voivodeship 2021-2030, Wałbrzych Sub-region, Marshal Office of the Lower Silesian Voivodeship, March 2022,
23. Territorial Just Transition Plan of the Lower Silesian Voivodeship 2021-2030, Zgorzelec District, Marshal Office of the Lower Silesian Voivodeship, March 2022,
24. Lower Silesian Voivodeship Sejmik Resolution No. XLI/1405/17 of 30 November 2017 on the introduction of restrictions and bans on the operation of fuel-burning systems in Wrocław Municipality,
25. Lower Silesian Voivodeship Sejmik Resolution No. XLI/1406/17 of 30 November 2017 on the introduction of restrictions and bans on the operation of fuel-burning systems in Lower Silesia's health resorts;
26. Lower Silesian Voivodeship Sejmik Resolution No. XLI/1407/17 of 30 November 2017 on the introduction of restrictions and bans on the operation of fuel-burning systems in Lower Silesia, excluding Wrocław Municipality and health resorts.
27. Act of 20 May 2016 On Energy Efficiency (consolidated text of Dz.U. /Journal of Laws/ of 2021, item 468 as amended),
28. Act of 3 October 2008 on the Provision of Information on the Environment and its Protection, Public Participation in Environmental Protection, and Environmental Impact Assessment (consolidated text of Dz.U. /Journal of Laws/ of 2021, item 2373 as amended) and Act of 16 April 2004 on Nature Protection (consolidated text of Dz.U. /Journal of Laws/ of 2020, item 55 as amended) and Act of 3 February 1995 on Protection of Agricultural and Forest Land (consolidated text of Dz.U. /Journal of Laws/ of 2021, item 1326 as amended) with respect to allocating land for non-agricultural and non-forest purposes,
29. Act of 20 May 2015 on Renewable Energy Sources (consolidated text of Dz.U. /Journal of Laws/ of 2021, item 610, as amended),
30. Lower Silesian Voivodeship Sejmik Resolution No. XLI/1405/17 of 30 November 2017 on the introduction of restrictions and bans on the operation of fuel-burning systems in Wrocław Municipality,
31. Lower Silesian Voivodeship Sejmik Resolution No. XLI/1406/17 of 30 November 2017 on the introduction of restrictions and bans on the operation of fuel-burning systems in Lower Silesia's health resorts;
32. Lower Silesian Voivodeship Sejmik Resolution No. XLI/1407/17 of 30 November 2017 on the introduction of restrictions and bans on the operation of fuel-burning systems in Lower Silesia, excluding Wrocław Municipality and health resorts.
33. LOWER SILESIA VOIVODESHIP SEJMIK RESOLUTION No. XXI/505/20 of 16 June 2020 on the adoption of an air protection programme for Lower Silesia areas where the permissible and target levels of substances in the air were exceeded in 2018, accompanied by a short-term action plan.
34. Zjawisko ubóstwa energetycznego w Polsce, w tym ze szczególnym uwzględnieniem zamieszkujących w domach jednorodzinnych, P. Lewandowski, A. Kielczewska, K. Ziolkowska, IBS Research Report 02/2018,
35. Principles for the update of the Energy Policy of Poland until 2040 (EPP2040). Strengthening Energy Security and Independence; a document adopted by the Council of Ministers on 29 March 2022,

