Polish Energy Transition Path

Booklet

Warsaw, October 2022

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Introduction

This booklet summarizes the Polish Electricity Association (pol. *Polski Komitet Energii Elektrycznej*, PKEE) report about the transition of the polish energy sector in the scope of achievements and further actions in the implementation of the climate and energy policy by the energy sector.

Reducing greenhouse gas (GHG) emissions and the negative impact humans have on the environment are at the heart of climate policy at global and European Union (EU) levels. The implementation of an ambitious climate policy places the EU in the role of a world leader in climate protection, with the long-term goal of achieving climate neutrality by 2050. Poland, which is a Member State of the EU since 2004, is also committed to achieving these climate goals.

Poland is also actively involved in global initiatives in the field of climate policy by being a party to the United Nations Framework Convention on Climate Change (UNFCCC) since 1994 and the Kyoto Protocol since 2002, and ratifying the Doha Amendment and Paris Agreement.

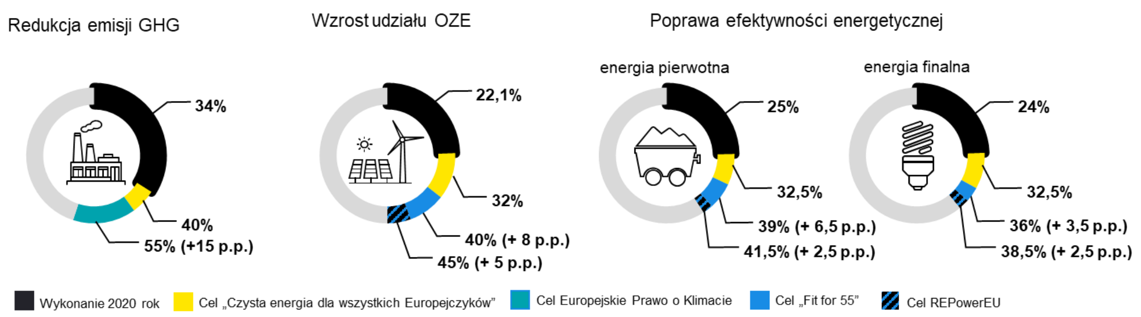
The scope of transformation of the Polish energy sector is much wider and more expensive than in the majority of EU countries. One of the main reasons behind it is very specific historical conditions and a high proportion of coal in the energy production mix. Transitioning to renewable energy as a main source of energy requires not only a technological reconstruction of the energy sector, but also a significant increase of production of renewable energy for the purpose of replacing fossil fuels in transport and heat production (among others). Moreover, an additional challenge for the reconstruction of the energy sector in the upcoming years will be the implementation of the transition in the conditions of destabilized fuels and electricity markets.

Conducting a swift energy transition in Poland requires full commitment from all interested parties. Power companies play a crucial role in this process as they are at the forefront of the fuel and energy transition. The impact of GHG emissions on climate change, care for human health, need for sustainable development, and minimizing the impact of energy sector on the environment are factors which motivate energy companies to carry out ambitious actions towards energy transition.

1. Implementation of the climate policy in Poland

Poland takes an active part in all UN climate protection actions, which is proven by the fact that the first global obligation of a 6% reduction in GHG emissions was fulfilled in advance[1]. Further global obligations were undertaken by Poland as a part of the EU. EU's ambition is to become a leader in climate protection actions and the EU was the first to present the ambitious target of achieving climate neutrality by 2050. The first EU targets for 2020 assumed reduction of GHG emissions by 20% and for 2030 the target was increased up to as much as 40%. The accumulation of undesirable phenomena caused by climate change and the need to accelerate the reduction of fuel imports forced further actions. As a result, the 2030 GHG emission reduction target was increased to 55%[2]. To achieve this target European Commission prepared a proposal for the "Fit for 55" package. Moreover, because of the Russian invasion of Ukraine in February 2022 and resulting necessity to rapidly reduce EU Member States' reliance on imported energy resources, the EU announced a new plan – REPowerEU, which proposes even higher targets than the "Fit for 55" package.

Summary of goals resulting from EU regulations until 2030



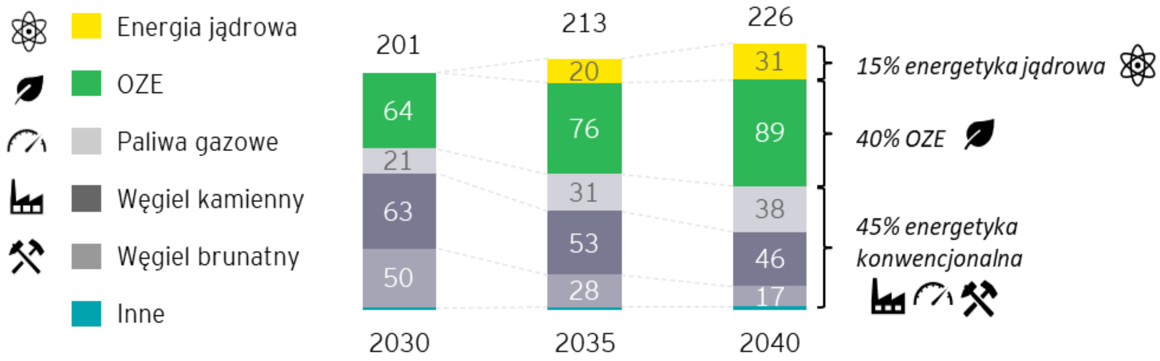
Source: Own study based on information and documents of the European Commission pertaining to the "Clean Energy for All Europeans, "Fit for 55", and REPowerEU.

Poland has met its EU targets for 2020 by reducing total GHG emissions by more than 20%[3]. Moreover, the share of renewable energy sources (RES) in final energy consumption was increased to approx. 16.1%[4]. In relation to the energy efficiency increase, the value of primary and final energy consumption reached 96.5 Mtoe and 71 Mtoe, respectively, which were close to the targeted 96.4 Mtoe of primary energy consumption and 71.6 Mtoe of final energy consumption.

In the long-term perspective, the energy transition and counteracting climate change in Poland will be carried out on the basis of strategic documents, most importantly Energy Policy of Poland until 2040 (PEP2040).

[1] In 2012 relative to 1990 levels
[2] The arrangements to increase the GHG reduction target to at least 55% by 2030 are included in the regulation containing the European Climate Law, which was adopted in July 2021.
[3] Compared to 1990 levels, based on data from EUROSTAT
[4] Compared to the 15% target, based on data from EUROSTAT

Forecast of gross energy mix of Poland according to PEP2040 [TWh]

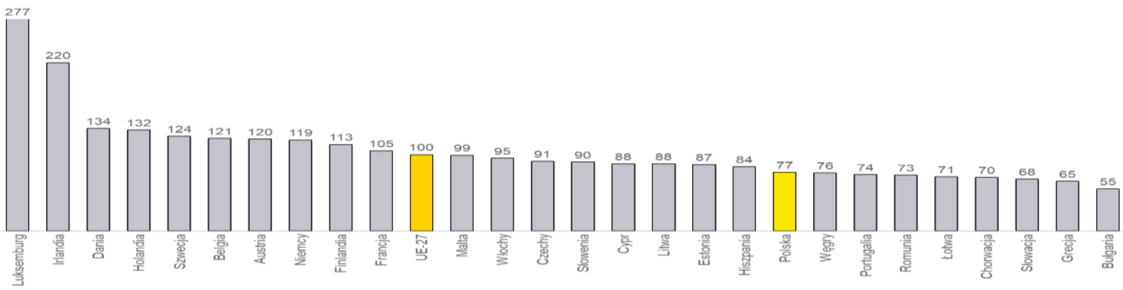


Source: Own study based on PEP2040.

2. Implementation challenges of the transformation

Due to geopolitical conditions until 1990, the Polish economy developed at a much slower rate than the economies of Western Europe. Achieving economic development close to the EU average will result in an increase in electricity consumption despite energy savings resulting mainly from the implementation of measures to improve energy efficiency.

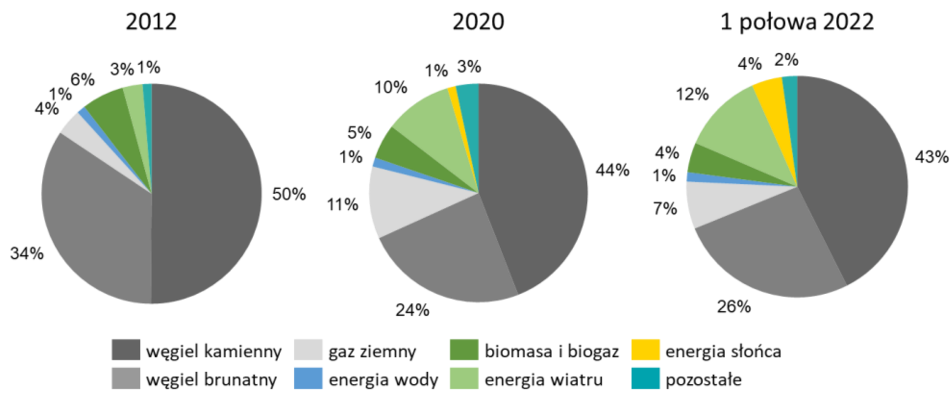
GDP per capita in Poland and EU countries GDP per capita (EU27 = 100) in 2021 according to the purchasing power parity of the zloty



Source: Own study based on data from EUROSTAT

The energy sector in Poland, due to historical and geopolitical conditions, was based on fossil fuels - hard coal and lignite. Nevertheless, the share of energy generated from low- and zero-emission sources is increasing gradually and consistently, and therefore the emission intensity of electricity production in Poland is steadily decreasing[5].

Share of energy carriers in electricity production in 2012 and 2020 and the first half of 2022



Source: Own study based on data from ARE and GUS

Reduction in the production of hard coal and lignite is directly connected with the reduction of their use by the energy sector. The peak of hard coal extraction in Poland occurred 30-50 years later than in countries such as France, Great Britain or Germany. These countries have shut down their mining operations altogether only in recent years, which illustrates the scale of time that Poland needs to effect changes in the mining sector. Poland is trying to carry out reforms in the mining industry in an evolutionary manner, while maintaining social protection and creating new jobs. This requires the transformation to be spread over many years.

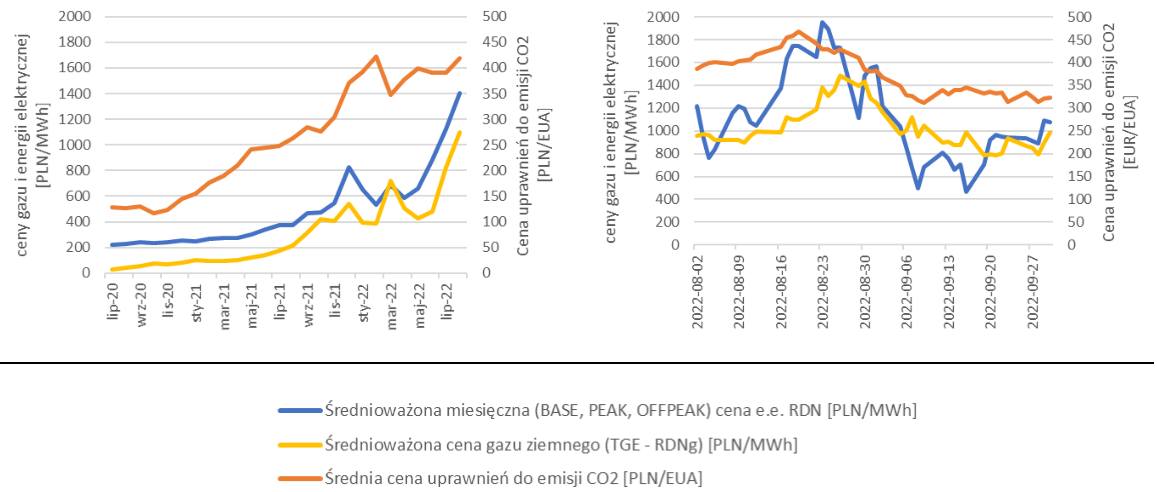
[5] Poland reduced unit GHG emissions by over 90% relative to the value of Poland's GDP from 1990 to 2020, according to data from the World Bank.

In order to avoid sector barriers to economic growth, it is necessary to maintain a stable supply of electricity in the required quantities and at acceptable prices.

In recent years, there has been a significant increase in the price of CO_2 emission allowances and energy resources. Between February 2018 and February 2022, the price of the allowances increased over ten-fold[6]. Natural gas and hard coal prices multiplied several times in the last two quarters of 2021 due to the accumulation of several events[7] relative to prices observed at the beginning of this year[8]. The Russian invasion of Ukraine in February 2022 further destabilized energy markets, especially in Europe, which was heavily dependent on imports of energy resources.

The destabilization of energy commodity markets has led to unprecedentedly high electricity prices on the wholesale market (mainly due to extremely high prices of natural gas), reaching up to PLN 1,800/MWh. The persistence of such high prices would have catastrophic consequences for the energy market and end-users, and consequently would lead to an economic downturn.

Increase in the prices of natural gas and CO_2 emission allowances and the resulting electricity prices in August and September 2022	**Increase in the prices of natural gas and CO_2 emission allowances and the resulting electricity prices in August and September 2022**



Source: Own study based on data from World Bank

To mitigate the effects of extremely high energy prices in 2022 and in forward contracts for 2023, on 6 October 2022, Council Regulation 2022/1854 on an emergency intervention to address high energy prices was published [9](hereinafter referred to as the "Regulation"). The solutions adopted in the Council Regulation include intervention in the energy market and the activities of its participants, unprecedented in the history of the EU. It is based on instruments redirecting surplus profits to protective measures for end-users (establishing a cap on the market revenues obtained from electricity generation using inframarginal technologies[10] or a mandatory solidarity contribution from surplus profits in the oil, gas, coal and refinery sectors). Efforts to reduce electricity consumption during peak hours are also essential.

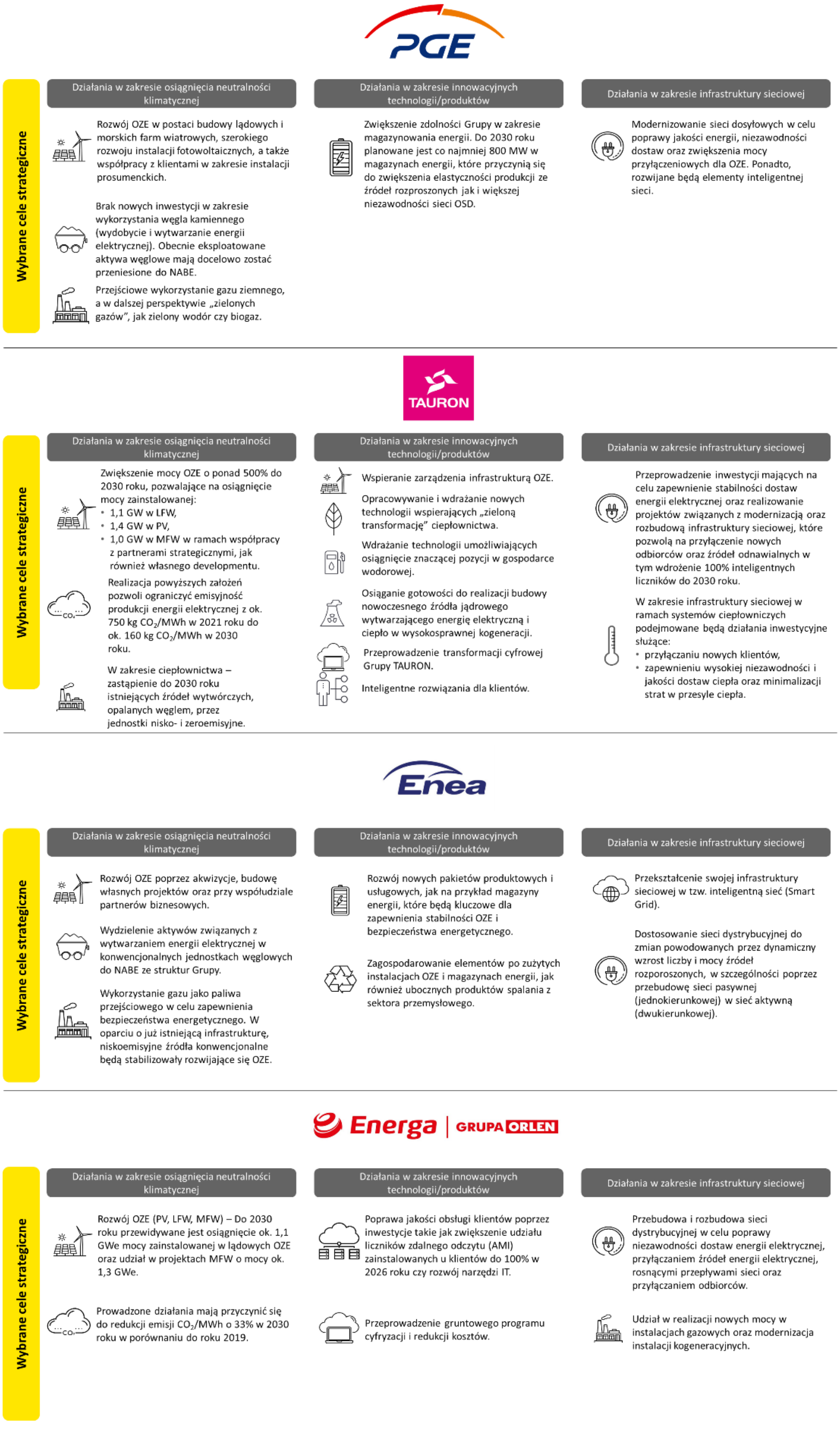
Poland is actively involved in developing intervention solutions at the EU level, while simultaneously implementing a number of solutions at the national level. In September, the system regulation was

[6] Based on data from EEX – The European Energy Exchange.
[7] First, increased demand for electricity, especially in China and India. Second, adverse weather phenomena including droughts in several regions, cold winter in the EU, floods affecting coal production and third, political conditions such as a ban on Chinese coal imports to Australia
[8] According to quotes and indices from ICE Dutch TTF Natural Gas Future, Coal (API2) CIF ARA (ARGUS-McCloskey) Futures
[9]https://eur-lex.europa.eu/legal-content/PL/TXT/?uri=uriserv%3AOJ.LI.2022.261.01.0001.01.POL&toc=OJ%3AL%3A2022%3A261I%3ATOC
[10] According to the content of the Regulation; those using wind, solar, geothermal, hydroenergy from power plants without reservoirs, biomass, waste, nuclear and lignite, crude petroleum products, peat

amended, specifying the method of calculating offer prices on the balancing market. The introduction of this regulation significantly lowered clearing prices on the balancing market, which will directly reduce the level of market prices in other market segments. Regulations developed at both EU and national levels are intended to ensure, among other things, the ability to implement protective measures for the most vulnerable end-users.

3. Strategic directions of development of Polish energy groups

Poland’s strategic plans are also reflected in the strategies of the largest Polish energy groups, which assume a significant increase in the share of renewable energy sources and the implementation of network investments supporting RES integration for the coming years.



The supporting members of PKEE appreciate the impact of ESG on their further development. The ESG aspects are incorporated into the strategies and operation plans of energy companies.

Selected ESG activities of PGE, ENERGA, ENEA and TAURON

	PGE	ENERGA	ENEA	TAURON
Czy elementy ESG są uwzględnione w strategii?	√	√	√	√
Czy elementy ESG są uwzględnione w planach operacyjnych?	√	√	√	√
E Przykład celu w zakresie Środowiska (Environment)	Osiągnięcie neutralności klimatycznej najpóźniej do 2050 roku	Polityka bioróżnorodności – usystematyzowanie podejścia	Działania na rzecz efektywności energetycznej	Dążenie do minimalizacji zużycia węgla kamiennego i osiągnięcie neutralności klimatycznej do 2050 r.
S Przykład celu w zakresie Społeczeństwo (Social)	Sprawiedliwa transformacja	Budowanie świadomości społecznej, obywatelskiej, konsumenckiej i ekologicznej	rozwój współpracy ze społecznościami lokalnymi (ruchy miejskie i samorządy)	Wspieranie działań na rzecz dobra publicznego oraz efektywny i transparenty dialog
G Przykład celu w zakresie Ład Korporacyjny (Governance)	Bezpieczeństwo teleinformatyczne	Opracowanie polityki klimatycznej, Identyfikacja ryzyka fizycznego i regulacyjnego dot. zmian klimatu	Nowoczesny, transparentny i etyczny Ład Organizacyjny na wszystkich szczeblach w całej GK ENEA	Zarządzanie Grupą TAURON przy zachowaniu ładu korporacyjnego, cele zarządcze powiązane z ESG
Przykład projektu w zakresie ESG	Centrum Rozwoju Kompetencji, które tworzy możliwości przekwalifikowania pracownikom związanych z węglem brunatnym, głównie na specjalności związane z OZE	Realizacja celów ESG została włączona do Karty Celów menedżerskich	Ogólnopolską kampania edukacyjna #BałtykDlaPokoleń, której celem jest zwrócenie uwagi na zagrożenia dla ekosystemu Morza Bałtyckiego ze strony zatopionej amunicji i broni chemicznej z okresu II Wojny Światowej	Inwestycje w OZE w ramach realizacji Zielonego Zwrotu TAURONA, w tym na terenach poprzemysłowych

Source: Own study based on CSR reports of supporting members of PKEE

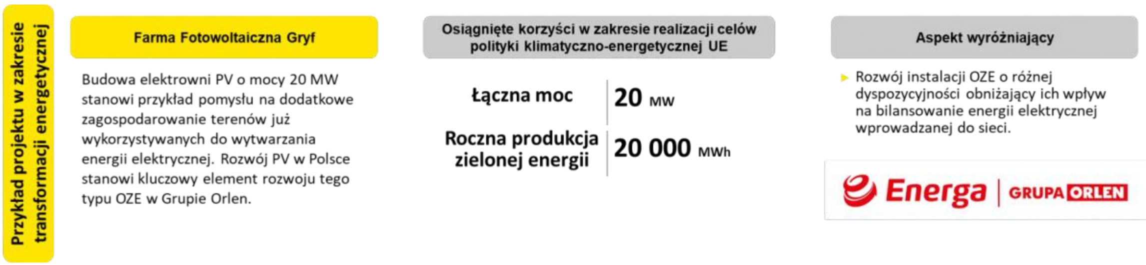
According to the government program, the acceleration of investment processes is to be achieved, among other things, through structural changes in the energy sector, including the spin-off of coal assets and their concentration in the National Energy Security Agency (pol. *Narodowa Agencja Bezpieczeństwa Energetycznego*, NABE). NABE will conduct activities related to maintenance and management of current coal assets, enabling Polish energy companies to accelerate investments in low- and zero-emission energy sources as well as transmission and distribution infrastructure. NABE will relieve the energy sector of the burden on financial markets related to the possession of a coal portfolio and facilitate acquisition of the necessary capital on the financial markets.

NABE is to contain over 70 coal-fired units that are currently owned by PGE Polska Grupa Energetyczna S.A., ENEA S.A., TAURON Polska Energia S.A., and ENERGA S.A. (which is currently owned by PKN ORLEN S.A.). Coal assets are to be purchased by PGE Górnictwo i Energetyka Konwencjonalna S.A. (PGE GiEK), which will then be transformed into NABE. According to the approved schedule, NABE will be functional by the end of 2022.

4. Opportunities and challenges in the field of REN and low emission electricity sources development

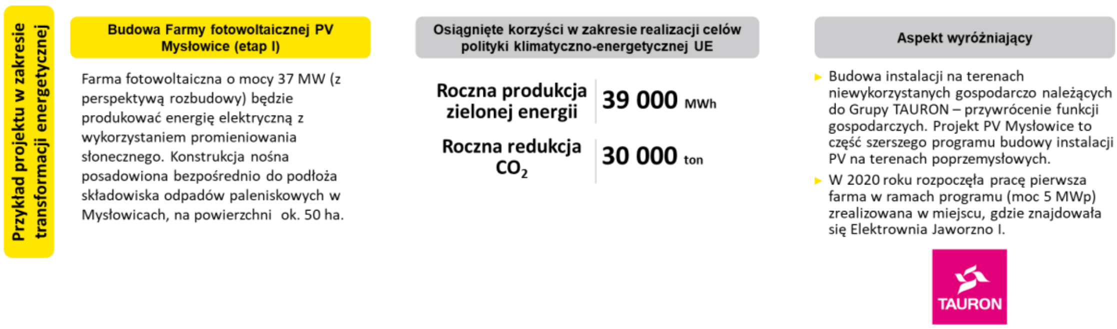
The development of RES is one of the key aspects of Poland's energy transition, supporting both the achievement of climate goals and the improvement of energy security. PEP2040 assumes a significant increase in RES generation capacity – by 2040, 40% of electricity is to come from RES, which is an increase of over 23 percentage points relative to 2020. According to the assumptions for the PEP2040 update, the share of RES in electricity production may increase up to 50% by 2040.

Example of an RES development project carried out by ENERGA



Source: Own study based on data from ENERGA

Example of an RES development project carried out by TAURON



Source: Own study based on data from TAURON

Additionally, the development of new areas such as offshore wind farms (OWFs) or nuclear technologies will initiate building up of the value chain for these sectors, which will support creation of new jobs and development of competences of Polish workers. This will support implementation of the concept of just transition.

Example of a project by PGE in relation to Offshore Wind Farm development

Przykład projektu w zakresie transformacji energetycznej

Morska Farma Wiatrowa	Osiągnięte korzyści w zakresie realizacji celów polityki klimatyczno-energetycznej UE	Aspekt wyróżniający
Projekt MFW realizowany w dwóch fazach: Baltica 2 i Baltica 3, polegający na wybudowaniu i przekazaniu do eksploatacji morskiej farmy wiatrowej wraz z przyłączaniem jej do Krajowego Systemu Elektroenergetycznego. Największa morska farma wiatrowa w polskiej części Morza Bałtyckiego, to wspólna inwestycja PGE i Ørsted, do której realizacji użyte zostanie 181 turbin wiatrowych rozmieszczonych na obszarze 582 km^2.	**Łączna moc** **2544** MW **Uniknięta emisja CO_2** **8 013 600** ton	▸ Zastosowanie kabla eksportowego o napięciu 275 kV po raz pierwszy na świecie w inwestycji MFW i użycie nowoczesnego typu fundamentu „TP less monopile”.

Source: Own study based on data from PGE

The rapid development of weather-dependent RES could give rise to challenges related to discrepancy of RES-based electricity generation and final energy consumption, as well as challenges related to its transmission, storage or reservation. The development of distributed energy sources changes the nature of distribution network operations through two-way power flows and the need to address fluctuations in network performance. It is therefore necessary to direct adequate sources for the expansion and reconstruction of networks, development of long and short term energy storages and infrastructure supporting network management.

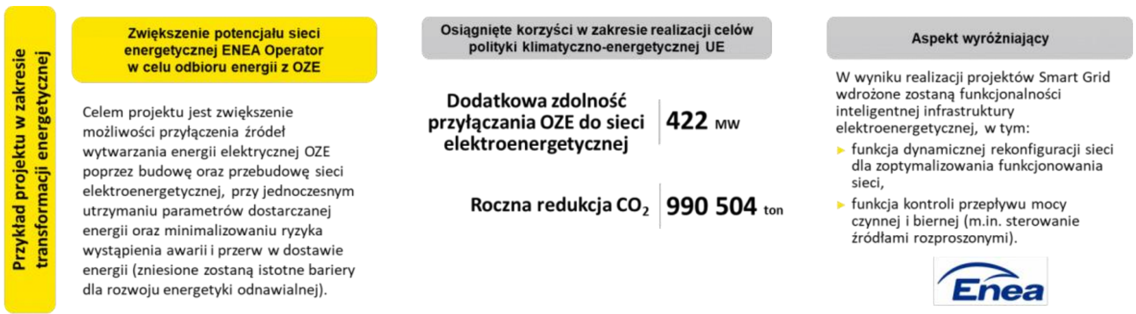
5. Opportunities and challenges in the field of electricity transmission and distribution

Development of transmission and distribution networks is an important element of the transition of the power system in Poland. Without further development of the networks supported by adequate investment outlays, it will not be possible to increase the share of renewable energy sources or introduce nuclear energy to the system. As a result, this can be a barrier for energy transition in general.

Support in operation of the transmission network and development of cross-border electricity flows will be possible thanks to development of interconnections such as, among others, “Harmony Link” between Poland and Lithuania. Due to the planned further significant development of cross-border connections and new energy sources (including offshore wind farms and nuclear power plants) located in the northern part of Poland, investments in the transmission network will be necessary to enable connection of large facilities and transmission of energy from the north to the south. In total, the investment costs for development of transmission networks can reach up to 7 bn EUR[11].

Changing the country’s electricity system from a centralized model based on one-way power flow from large sources to consumers to a model with a significant share of distributed generation sources requires transition into active networks enabling two-way power flow. Distribution networks will have to operate in a more flexible manner while maintaining stable operating parameters and enabling the connection of new distributed energy sources. This requires significant reconstruction and expansion of the grid. Such investments will require significant financial outlays borne by both distribution system operators and entire energy groups. The largest of these, i.e. PGE, TAURON, ENEA and ENERGA, intend to allocate half of their investment outlays to projects in this area according to their strategic documents. As part of these measures, apart from reconstruction of the network, installing smart meters, digitization, and automation of the network and of network services is planned.

Example of a project by ENEA in relation to distribution networks



Source: Own study based on data from ENEA

Outlays for the implementation of investments in the distribution sector may reach as much as 30 billion EUR[12] by 2030. For the implementation of such large investment programs in such a short time, additional financial support utilizing national and EU funding is necessary as well as allowing the use of simplified procedures for obtaining the required permits.

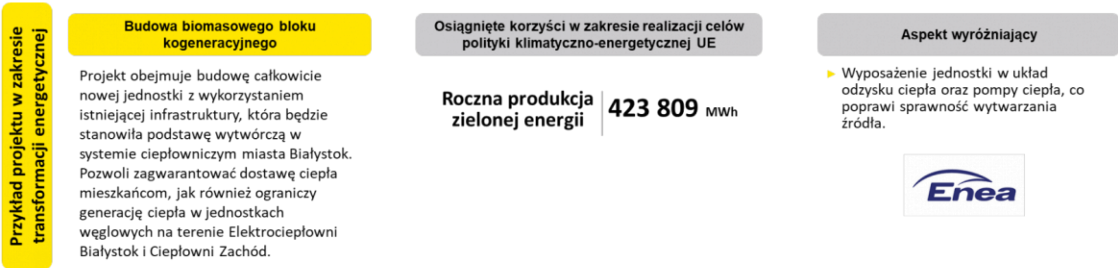
[11] Based on data from PSE
[12] Based on data provided by Polish Power Transmission and Distribution Association (PTPiREE) on the Charter of Effective Transformation.

6. Opportunities and challenges in the field of district heating

District heating in Poland, similarly to the energy sector, has developed based on the use of fossil fuels. Currently the most commonly used source of renewable energy is biomass, which accounts for almost 10% of total heat production, with the remaining sources representing less than 1% of share in the heat generation structure.

Larger district heating systems are generally supplied with heat from combined heat and power (CHP) sources, but there are still many systems powered by water boilers that can be replaced by CHP sources. Increasing the share of high-efficiency cogeneration makes it possible to use primary energy more efficiently and thus to reduce GHG emissions. Transitionally, further reduction of GHG emissions may take place by replacing coal-fired units with those fuelled by natural gas. In the long term, fossil fuels used in cogeneration systems will be replaced by renewable gases such as green hydrogen or biomethane.

Example of a project by ENEA in relation to the development of the district heating sector



Source: Own study based on data from ENEA

The district heating sector is facing many challenges in the field of energy transition. It is necessary to almost completely reconstruct heat supply sources, reconstruct the network to enable cooperation with distributed sources, mainly weather-dependent RES.

It should be emphasized that the planned legislative changes as part of the "Fit for 55" package[13] involve, among other things, stricter requirements for the recognition of a given district heating system as energy-efficient. According to the draft amendment to the Energy Efficiency Directive[14] from 2021, the first tightening of the requirements will take place in 2026, and then in 2035, 2045, and 2050.In accordance with the European Commission's (EC) proposal, from 2050 an efficient district and cooling heating system should be powered only by heat from RES and waste heat, however heat from RES must be equal to at least 60%. At the same time, the draft amendment provides for the introduction of a direct CO_2 emission factor for high-efficiency cogeneration units (based on fossil fuels) of 270 gCO_2/KWh, which means coal-fired sources could not be considered as high-efficiency cogeneration units (the emission factor of coal-fired units per unit of energy in fuel was approx. 340 gCO_2/kWh[15]). As a consequence of the this situation – in agreement with the EC's proposal – district heating systems that are based upon coal-fired cogeneration units, from January 1 January 2026 will not be able to obtain or maintain the status of energy-efficient district heating and cooling system (according to the EC's proposal, from 2026 the minimum share of high-efficiency cogeneration in the system must be equal to at least 80% for the system to be considered energy-efficient).

[13] As part of the proposal for a Directive of the European Parliament and of the Council on energy efficiency (recast) (COM/2021/558)
[14] Draft amendment to the Directive of the European Parliament and of the Council on energy efficiency (recast) (COM/2021/558)
[15] Based on data from KOBIZE for 2019.

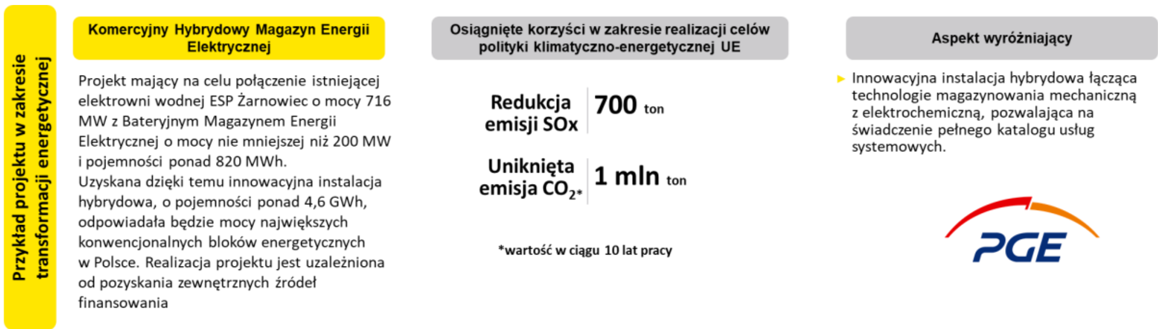
Companies whose systems do not obtain the status of an efficient district heating and cooling system will not obtain support from public funds (EU or national) for network infrastructure projects. The participation of such funds is necessary for the implementation of investment activities related to the reconstruction of district heating systems. In view of the above, it is paramount to continue efforts that aim to ease these requirements or to introduce exemptions for Member States with a very high share of coal in district heating.

7. Opportunities and challenges in the fields of energy storage as well as hydrogen projects

Weather-dependent RES will have an increasing share in the Polish energy mix. Consequently, in order to enable further development and use of RES, it will be necessary to invest in energy storage solutions.

Large-scale short-term storage facilities can store large amounts of energy from large-scale sources (nuclear power and partly OWFs) for peak consumption periods. Another function of such storage facilities will be to store energy generated cyclically, but only for a part of the day (e.g. photovoltaic (PV) sources), ensuring an almost constant power supply to large loads (e.g. batteries or electrolysers). Currently, pumped storage power plants (PSPs) have the largest share in such storage facilities, but further development of this technology is limited due to the small number of suitable locations for PSP construction. Battery storage technologies, which are constantly being improved, have significantly higher development potential.

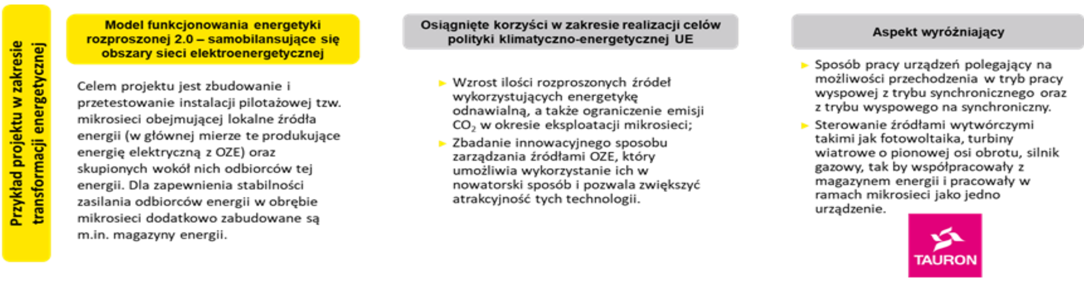
Example of a project by PGE in relation to the development of large-scale energy storage



Source: Own study based on data from PGE

Small-scale energy storage (mainly battery-powered) should be developed especially by energy consumers with PV sources with the highest energy consumption during non-insolation hours. Such warehouses can also be installed in MV/LV or HV/MV network nodes as collective for many prosumers. Such an arrangement of storage facilities limits the two-way power flows in the distribution networks and may reduce the expenditure for their expansion.

Example of a project by TAURON in relation to the development of small-scale energy storage



Source: Own study based on data from TAURON

Large-scale long-term storages (for periods counted in weeks and months), can accumulate large amounts of energy, mainly for periods of low production in wind and PV plants. In the future, the role of such storage facilities may be played by power-to-gas-to-power systems – for example, by producing hydrogen from electricity generated in wind, PV or nuclear power plants, hydrogen storage, or electricity production in a hydrogen-fired gas unit.

Example of a project by ENERGA in relation to the development of hydrogen technologies

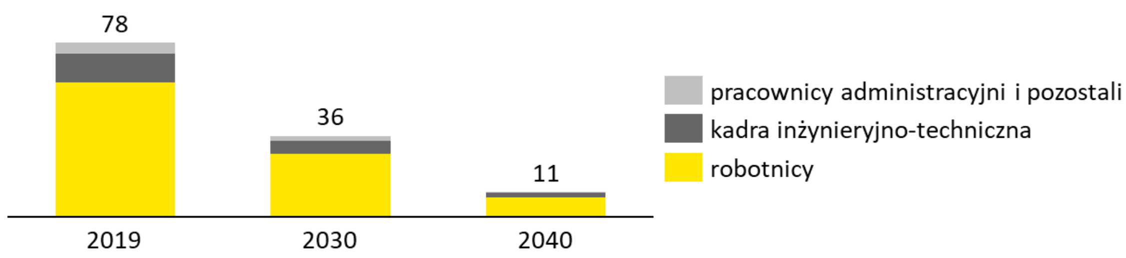
	Wdrożenie celów strategii wodorowej Grupy Orlen do 2030 r.	Osiągnięte korzyści w zakresie realizacji celów polityki klimatyczno-energetycznej UE	Aspekt wyróżniający
Przykład projektu w zakresie transformacji energetycznej	Strategia Grupy Orlen do 2030 r. zakłada budowę zrównoważonego portfela obszarów biznesowych, dla których wodór jest istotnym elementem. Strategia Wodorowa ma na celu zapewnienie Grupie Orlen pozycji lidera w Europie Środkowej. Strategia zakłada działania w 4 obszarach tj.: (I) mobilność, (II) rafineria i petrochemia, (III) przemysł i energetyka oraz (IV) badania i rozwój.	Umożliwienie transformacji polskiej gospodarki w kierunku zeroemisyjnej.	Wdrożenie i rozwój technologii elektrolizerów. Energa | GRUPA ORLEN

Source: Own study based on data from ENERGA

8. Just transition

Despite enormous changes in the sector and a reduction in employment by approx. 80% since 1989, Poland still has a long way to go in transforming the mining sector. According to estimates of the Joint Research Center, over 200,000 people work in mining and directly related industries at the EU level[16]. More than half of them work in Poland.

Projected employment in the hard coal mining sector in Poland until 2040 [in thousand persons]



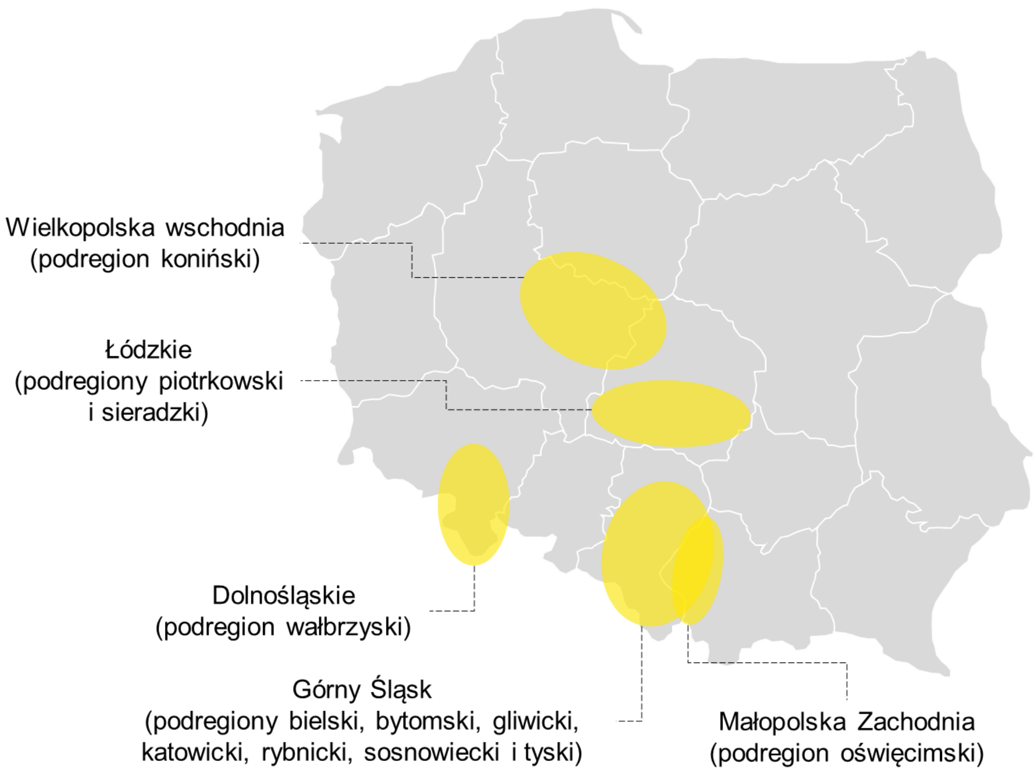
Source: Own study based on IBS and ARP data

A smooth and quick transformation towards climate neutrality requires a comprehensive approach to ongoing changes, which also means addressing problems of energy poverty and the need to reconstruct the economies of entire regions.

Territorial Just Transition Plans have been prepared for areas most vulnerable to the effects of the energy transition. These documents indicate the roadmap for moving away from fossil fuels with perspectives till 2030 and 2050. They also list the resulting challenges in the social, economic and environmental areas. The preparation of Territorial Just Transition Plans was supported by PKEE members. TAURON was actively involved in the development of the Western Lesser Poland Territorial Just Transition Plan by joining the working team preparing this document. In turn, PGE actively supported the process that led to the European Commission recognizing in 2022 the Łódź Voivodeship as one of the regions supported by the Just Transition Fund.

[16] Mandras, G., and Salotti, S. 2021. Indirect jobs in activities related to coal, peat and oil shale: A RHOMOLO-IO analysis on the EU regions. JRC Working Papers on Territorial Modelling and Analysis No. 11/2021, European Commission, Seville, JRC127463

Regions to be covered by support as part of Just Transition Fund[17]

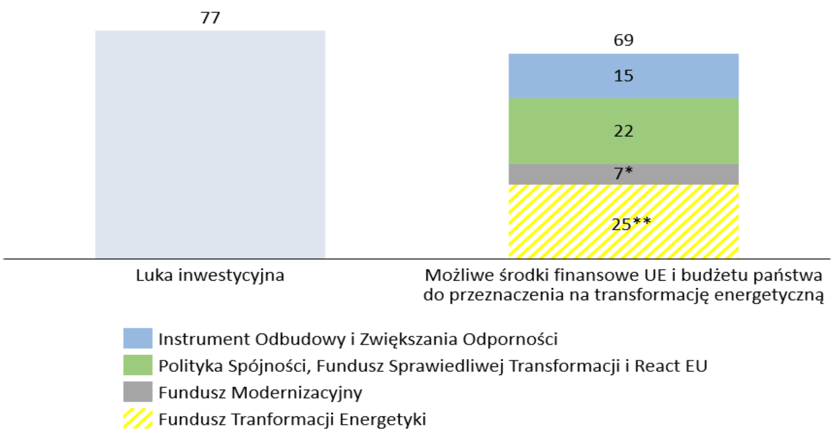


Source: Own study based on Partnership Agreement with Poland for the implementation of the 2021-2027 Cohesion Policy

[17] Final support from the Just Transition Fund may take place upon approval of the Territorial Just Transition Plan.

9. Financing the energy transition

Possibility to cover the investment gap using EU and state budget funds [in billion EUR]



*Source: Own study * till 2030 ** till 2031*

According to PEP2040, the value of investment outlays in the production, transmission and distribution of electricity and district heat until 2030 was estimated at 53 bn EUR. Additionally, taking into account the changing market environment, including rising EU's ambitions in terms of the pace of energy transition, these outlays may increase significantly. The estimated costs of the energy transition in the field of electricity, district heating and the necessary protective measures by 2030 may amount to as much as 135 bn EUR[18].

Given the scale of investment challenges related to the energy transition, these activities cannot be implemented only with the use of funds from energy groups and potential investors; they also require support from national and EU funds. The estimated investment potential of energy companies and private investors existing in Poland indicates that the shortfall may reach at least 77 bn EUR[19].

Along with its ambitious climate policy goals, the EU allocated funds in its 2021-2027 budget for supporting the energy transition and created mechanisms using funds from the EU emissions trading system. It is worth nothing that only part of the available funds will be available to the energy sector because a significant pool of funds will be directed to other entities involved in the energy transition. However, even the full use of support from EU instruments will not make it possible to cover the entire investment gap. Therefore, in order to cover the expenditure it will be necessary to, inter alia, search for additional sources of funding at both national and EU levels.

In this context, effective planning and a reliable approach by EU decision-makers and the European energy sector to the issue of the energy transition are of key importance, as the implementation of such broad measures will require significant efforts with a long-term impact on both the industry and the economy as a whole.

[18] EY study
[19]EY estimation based on PSE analyses and reports of energy companies

Summary

1. Poland is an active participant of climate protection actions both globally and in the EU. As a signatory to the UN Climate Convention, Poland fulfilled its global obligations to reduce GHG emissions, and as a member of EU achieved its 2020 climate targets. Currently it continues to implement further reduction plans with full commitment.

2. The EU aims to achieve climate neutrality by 2050, becoming a global leader in this field. Simultaneously, pursuit of this goal allows for a reduction in energy resource imports, especially hydrocarbons. The EU's operational targets are set for 2030 and 2050. Currently, work is underway to set more ambitious targets for 2030, with the GHG emissions reduction target set to increase from 40% to 55%.

3. The historical conditions of the Polish energy sector established the domination of coal technologies in the process of electricity generation. Domination of coal in the energy generation mix results in significantly higher costs of the transition towards climate neutrality and increases the time needed to reach its targets compared to other EU countries.

4. The electricity sector in Poland supports the EU in reaching its climate targets by making an important contribution towards the EU targets through investments in RES and other technologies that reduce GHG emissions, improving energy efficiency and reducing pollutant emissions.

5. The instability in the global energy commodity market that has lasted for over a year has led to a several-fold increase in prices, especially of natural gas and hard coal. When the situation began to stabilize, Russia's invasion of Ukraine destabilized the market again, raising gas prices to never-before-seen levels. This situation forces the acceleration of the reduction of dependence from imported energy resources, especially from Russia. The EU has developed REPowerEU – a plan which assumes that further increase in the use of RES (by increasing the target regarding RES share in final energy consumption) will play a significant role in decreasing fuel imports.

6. The destabilization of fuel and electricity markets and high prices of CO_2 emission allowances under the EU ETS are a threat towards the economic growth of the EU countries, extend the phenomenon of energy poverty and slow down the pace of energy transition. Both the EU and individual Member States are undertaking initiatives to lower fuel and electrical energy prices and introduce protective measures for the most vulnerable consumers.

7. For the rapid and effective implementation of the transformation of the energy sector, it is necessary to master new low- and zero-emission electrical energy generation technologies. It is important to conduct research and development work in a wide range so as to minimize the risk of development barriers for these technologies. Moving away from coal in the energy sector, as well as mine closures, will have a significant impact on employment and will cause social changes in mining regions, where over 100,000 people[20] work directly in the mining coal sector. Conducting a just transition of mining regions and reducing energy poverty will require significant financial outlays as well as protective measures.

8. By 2030, the financial resources of Polish energy groups and other investors, as well as the funds available under EU instruments, may not be sufficient to cover the total

[20] Data from 2018 based on Mandras, G., and Salotti, S. 2021. Indirect jobs in activities related to coal, peat and oil shale: A RHOMOLO-IO analysis on the EU regions. JRC Working Papers on Territorial Modelling and Analysis No. 11/2021, European Commission, Seville, JRC127463

investment outlays for the energy transition, both in the generation and distribution segment. It is necessary to search for further sources to support investment financing.

9. Further effective transformation of the energy sector requires the use of all available resources to stabilize electricity prices as soon as possible. In the conditions of economic recession and growing energy poverty, there is a risk that the energy transition may be slower or even stops altogether.