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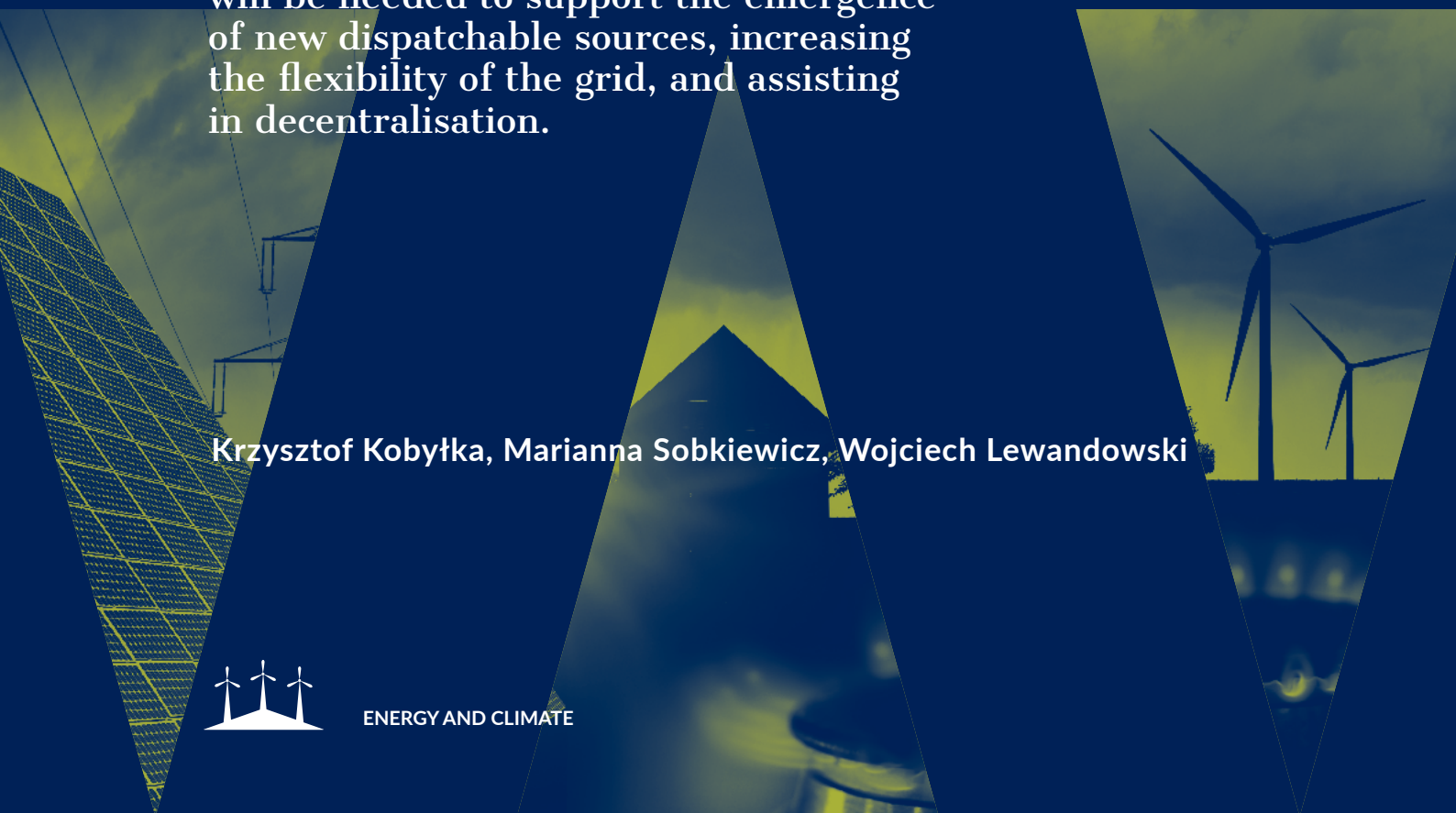
Green Strategic Autonomy

Policy to support the development of a sustainable energy system

With the development of RES, which will become the backbone of the electricity system in the coming years, Poland needs to prepare it for their integration. Systemic measures will be needed to support the emergence of new dispatchable sources, increasing the flexibility of the grid, and assisting in decentralisation.



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ENERGY AND CLIMATE

Green Strategic Autonomy.
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Policy to support the development of a sustainable energy system

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Key findings

- In a previous report[1], we defined the concept of 'Green Strategic Autonomy', the aim of which is to strengthen security in the European Union (including energy security) through the energy transition, i.e., largely through the development of renewable energy sources (RES). Key to its implementation is prompt decarbonisation, which entails shifting away from fossil fuels and improving energy efficiency to reduce energy demand. The resultant decrease in the demand for coal, gas, and oil would reduce the need for fossil fuel import, thus increasing the independence and energy security of the EU. It is important to bear in mind that sustainable development is a multi-faceted challenge: it is important to meet not only environmental objectives but also social and economic ones.

- The Russian invasion of Ukraine prompted a reorientation of energy policy in EU countries, including Poland. Like most Member States, Poland has diversified its fossil fuel suppliers in order to become independent from Russian import. However, unlike many other EU countries, the Polish government has not taken measures to promote energy conservation through policy (such as lowering temperatures in public buildings). Furthermore, Poland has one of the lowest shares of RES in final energy consumption and is not taking adequate measures to make up for its delay. While many Member States have taken measures to accelerate the development of renewables as a result of the Russian invasion, Poland still has not liberalised the 10H rule, which is currently the largest barrier to RES development in the country.

- Decarbonisation will involve increasing the use of electricity as an energy carrier. Sectors such as transport, heating, and industry will be almost fully or partially electrified. At EU level, it is estimated that electricity consumption will increase by about 40%[2], while for Poland this could be as much as a 2.5-fold increase by 2050[3].

- Poland is one of the slowest decarbonising countries and has one of the most carbon-intensive economies (in relation to GDP). It also ranks second in the EU in terms of the emissions intensity of electricity generation, producing around 70% of its electricity from coal-fired plants. Therefore, conventional generation units must be replaced, but also additional sources need to be built to meet the increasing demand for electricity.

1 K. Bocian, K. Laskowski, W. Lewandowski, *Polish investment needs for independence from Russian imports of raw materials*, Warsaw 2022.

2 McKinsey, *Transformation of Europe's power system until 2050, including specific considerations for Germany*, 2010, https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/epng/pdfs/transformation_of_europes_power_system.ashx.

3 Hauke Engel et al, *Carbon neutral Poland 2050: How to turn a challenge into an opportunity*, McKinsey, 2020, https://www.mckinsey.com/pl/~/media/mckinsey/locations/europe%20and%20middle%20east/poland/reports/carbon%20neutral%20poland%202050/neutral%20emissions%20poland%202050_report%20mckinsey.pdf.

- Due to their nature (i.e. low cost of energy production, no need for fuel, scalability and modularity), solar and wind sources will play a key role in decarbonisation. The current grids, designed for relatively larger, centralised generation units, were designed for one-way flow of energy from units to consumers. With a higher RES share in the system, the lower energy density of the sources and their dispersion, also at the level of distribution networks, will substantially change the way the system operates. As the share of RES and their variable production increases, the need for daily and seasonal balancing of the system will increase.

- Countries face the challenge of building a stable, resilient system that responds to the characteristics of renewable sources, while ensuring that the transition is economic and equitable. The evolution of the system should be based on three pillars: ensuring adequate energy supply, system flexibility, and decentralisation.

- Progress in the development of wind and solar sources in Poland over the last decade has been insufficient. The most important support mechanisms for renewable sources in Poland are the RES auction system and the 'My Electricity' programme, together with the regulatory environment for prosumers. The vast majority of the increase in installed capacity in recent years has been due to the development of prosumer PV installations, back in the days of more favourable compensation rules (net-metering). The change to net-billing and the existing barriers to obtaining grid connection permits will have a negative impact on the further development of RES in Poland.

- As the price of RES has fallen and these sources have reached economic maturity, RES projects are developing based on free-market models (such as cPPA). However, their uptake will require the removal of regulatory barriers and the stimulation of this market through adequate regulation. The most necessary measures include: liberalisation of the 10H rule, bureaucracy reduction, increasing the transparency of the energy market, and removing the barriers to obtaining grid connection (grid extension, transparency of the process, cable pooling, direct line). Independently of this, measures to support the development of civic energy models in the form of prosumers and energy communities should be expanded.

- Poland also lacks support for low-carbon dispatchable energy sources. Currently, the capacity market, which aims to maintain an adequate amount of available capacity in the system, mainly supports fossil fuel power plants. There is a need to update the rules of capacity market auctions in such a way that low-carbon sources are preferred.

- Flexibility of supply and demand will be another key element of the new system. In Poland, demand-side reduction is already supported through the power market (in the form of DSR). However, flexibility also requires the implementation of smart grid technology, including the installation of smart metering in households, to support the introduction of, among others, dynamic pricing. The development of energy storage, including support for hydrogen, will also be important. As generation is increased at the level of distribution networks, solutions are needed to enable local system balancing to avoid *curtailment* and *congestion*. Solutions such as adequate planning, support for storage at the distribution network level, market reform, and nodal pricing can help. At a systemic level, flexibility should also be supported by greater integration with neighbouring countries, i.e. increasing cross-border transmission capacity.

- Decentralisation is the natural direction for modular, scalable energy sources. RES allow for the diffusion and democratisation of energy. Therefore, support for prosumers and energy communities, i.e., support for local energy production and consumption, is very important. Solutions are also needed to support the redistributive effect, i.e. to increase the participation of lowest-income households in the democratisation of the energy system and to make energy more affordable for everyone.

- Poland lacks a clear political signal for committing to the green transition. An ambitious strategy, but with an appropriate system for monitoring & evaluating the progress of its implementation, could make for a significant improvement. Updating key strategic documents, such as the Polish Energy Policy 2040 (PEP2040) and the National Energy and Climate Plan 2021-2030 (NECP), should reflect an ambitious but realistic decarbonisation pathway for the electricity sector, with outlined supporting and monitoring policies and measures.

- It is essential that energy transition policies take into account the protection of vulnerable groups from the negative impacts of air pollution, climate change, as well as the transition support initiatives themselves. These measures should include redistribution to minimise their negative impact on the lowest income households.

1. Introduction – What is green strategic autonomy?

Strategic autonomy has become one of the overarching goals of EU policy in recent years. Although the first references by EU politicians to this idea date back to 2013[4], it has taken on particular significance following the outbreak of the COVID-19 pandemic, which shook global supply chains, thereby bluntly exposing the Union's dependence on imports of key raw materials and products. Already in the 1990s, the European Commission (hereafter: Commission, EC) realised that the EU's growing dependence on fuel imports posed a threat and cited nuclear energy and investment in the development of renewable energy sources as measures to enhance energy security[5]. Strategic autonomy is a broad concept with several slightly different meanings, which vary depending on the public policy area under discussion. However, they share a common denominator - EU security.

Dependence on fossil fuel imports is one of the greatest threats to the European Union's energy security. The answer should be to decarbonise the economy as soon as possible - hence the concept of green strategic autonomy, which we wrote about in our previous report in the context of the investments Poland needs to make in order to become independent of raw material imports from Russia[6]. We argued why the development of renewable energy sources and energy efficiency are the best ways to become independent from the supply of raw materials from outside the EU and thus strengthen the energy security of the Union.

The shift away from fossil fuels will involve an increase in the importance of electricity as an energy carrier. The need to eliminate technologies based on these raw materials in sectors such as transport, industry or heating will mean almost complete or partial electrification of these sectors. Electricity already accounts for about 23% of total final energy consumption in the European Union, and in Poland it is about 17%. Forecasts indicate that this figure could rise to as much as 55% in 2050 at EU level[7].

4 *EU strategic autonomy 2013-2023: From concept to capacity*, European Parliament, 8 July 2022, https://www.europarl.europa.eu/thinktank/pl/document/EPRS_BRI(2022)733589 .

5 Commission of the European Communities, *An Energy Policy for the European Union*, 13 December 1995, http://aei.pitt.edu/1129/1/energy_white_paper_COM_95_682.pdf .

6 K. Bocian, K. Laskowski, W. Lewandowski, *Green Strategic Autonomy. Polish investment needs for independence from Russian imports of raw materials*, Warsaw 2022, https://wise-europa.eu/wp-content/uploads/2022/08/Zielona-Autonomia-Strategiczna.pdf.

7 Paolo D'Aprile et al, *Net-Zero Europe: Decarbonization pathways and socioeconomic implications* (McKinsey, 2020), https://www.mckinsey.com/~/media/mckinsey/business%20functions/sustainability/our%20insights/how%20the%20european%20union%20could%20achieve%20net%20zero%20emissions%20at%20net%20zero%20cost/net-zero-europe-vf.pdf .

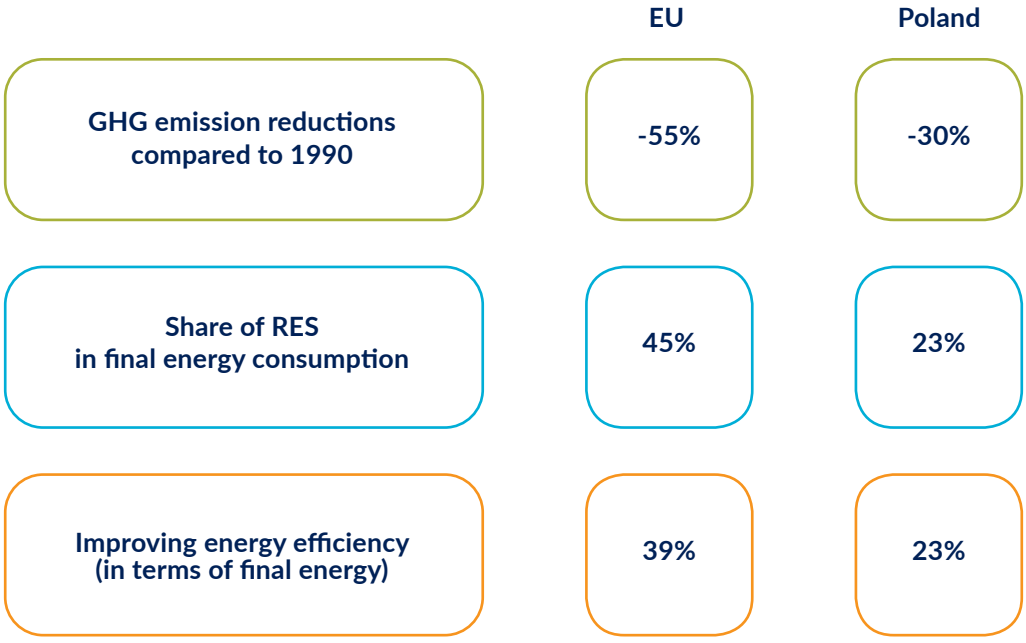
Electricity will therefore play a key role on the path to a climate-neutral economy. This means that the electricity system must not only decarbonise, but also grow. Our functioning in society, mobility, warmth, but also the functioning of the economy, heavy industry and manufacturing, will therefore depend on the reliability and continuity of the electricity supply. Such dependence will require a stable, secure system with high resilience to failures and other disturbances.

RES variables are placed at the centre of a decarbonised electricity system. Their intrinsic characteristic of generating electricity through inexhaustible solar and wind resources makes it possible to significantly reduce the consumption and import of fossil fuels - and, with a view to the next decades, to become completely independent of them. At the same time, this same characteristic makes energy production from these sources weather-dependent and non-dispatchable. In the report, we point out that the profit and loss account shows that RES should be the foundation of the energy transition. Therefore, in this context, the disadvantages and barriers of the green energy transition should be seen as challenges rather than obstacles, as the gains from it are in fact prerequisites for the environment, for society, as well as security in Europe. In the following report, we show how, from the level of public policies, and with which technologies and actions, can policy makers support the emergence of a new sustainable electricity system.

2. Poland at the tail end – the transformation ambition gap between Poland and the European Union

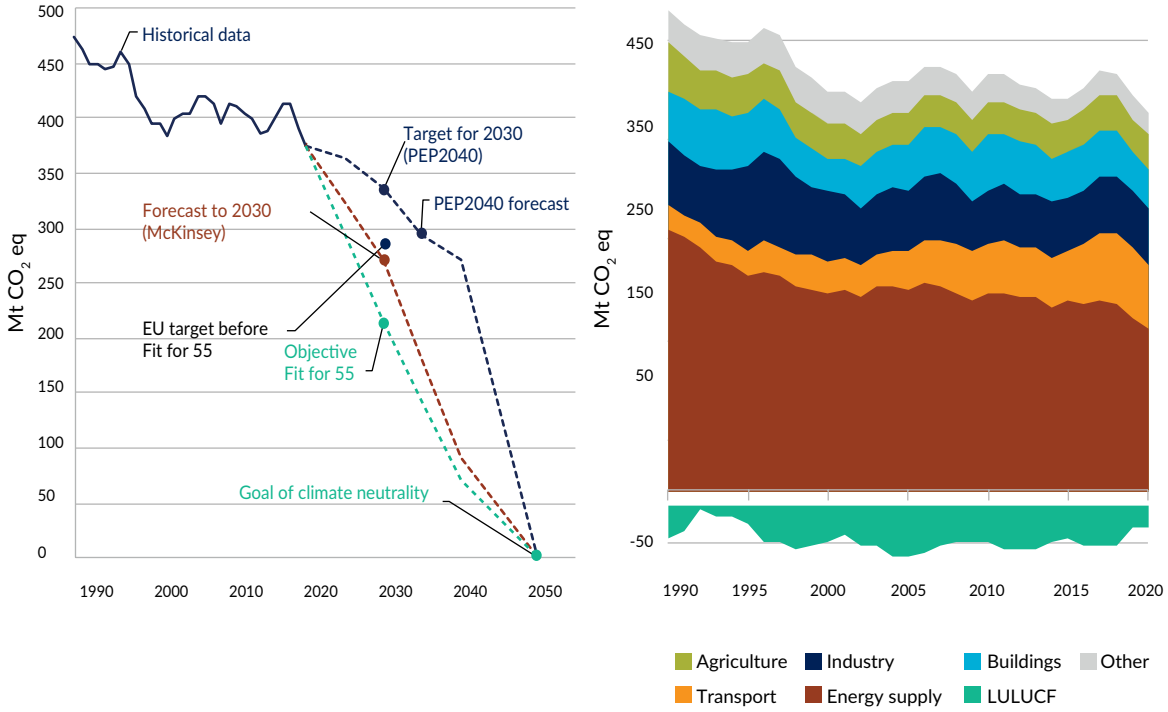
The REPowerEU plan, which the European Commission unveiled on 8 March 2022, is a set of measures to increase the resilience of EU energy systems in the face of the Russian invasion of Ukraine. REPowerEU assumes an acceleration of some of the EU's climate policy targets, which were put forward as part of the Fit for 55 package announced in July 2021. The Union's climate policy in previous years has not operated in isolation from security concerns, but Russia's invasion of Ukraine has put additional pressure on policymakers to minimise the EU economy's dependence on fossil fuel imports - particularly those from Russia. This direction therefore does not represent a revision of EU climate policy, but rather a strengthening of certain aspects of it and an increase in existing ambition. However, a significant ambition gap has remained between Poland and the EU for years - Poland is one of the slowest decarbonising EU member states, and national long-term strategic energy plans are not on a par with the EU's 2050 climate neutrality targets.

Figure 1. Comparison of Polish and EU climate targets for 2030



Source: Own elaboration based on European Commission documents on the Fit for 55 package and the REPowerEU plan and on Poland's Energy Policy until 2040.

Figure 1 and 2. GHG emissions in Poland 1990-2020, emission projections and reduction targets by 2050; GHG emissions in Poland 1990-2020 by sector



Source: Own elaboration based on European Commission documents, Polish Energy Policy until 2040 and KOBiZE data.

Poland has the second highest GHG intensity in electricity production of all EU countries[8], and only 17 % of the energy produced in the country comes from renewable sources - also one of the worst results in the EU[9]. This is a consequence of the lack of adequate public policies to support and stimulate the market to effectively decarbonise the energy sector. Some decisions by those in power even have the opposite effect, an example being the so-called 10H rule, which has almost completely blocked investment in onshore wind energy. In addition, there is a lack of regulation for many needed solutions (e.g. the direct line), and the state's ownership control of energy companies perpetuates their monopolistic position - thus holding back the development of RES-based energy. This is therefore primarily due to a lack of political will, i.e. an active decarbonisation policy and initiative on the part of Polish decision-makers, whose policy in this regard is mainly reactive to decisions at the EU level. In order to ensure security for the energy system, it is necessary to update the Polish energy and climate strategy, followed as soon as possible by the implementation of public policies that support the development of RES and their balancing methods. Otherwise, it will become increasingly difficult for Poland to catch up with the EU climate targets with each passing year, which will translate into lower energy security in the country. Moreover, if Polish decision-makers do not start pursuing a firm decarbonisation policy, the competitiveness of the Polish economy will gradually decline[10]. The high carbon intensity of the electricity system (Charts 3 and 4) translates into high levels of Scope 2 emissions (i.e., inter alia, indirect emissions

8 *Greenhouse gas emission intensity of electricity generation in Europe*, European Environment Agency, 26 October 2022, https://www.eea.europa.eu/ims/greenhouse-gas-emission-intensity-of-1.

9 *Poland*, Ember, 2022, https://ember-climate.org/countries-and-regions/countries/poland/.

10 We wrote more about this in our report *Zielone koło ratunkowe. Dostęp do czystej energii warunkiem konkurencyjności polskiego przemysłu.*

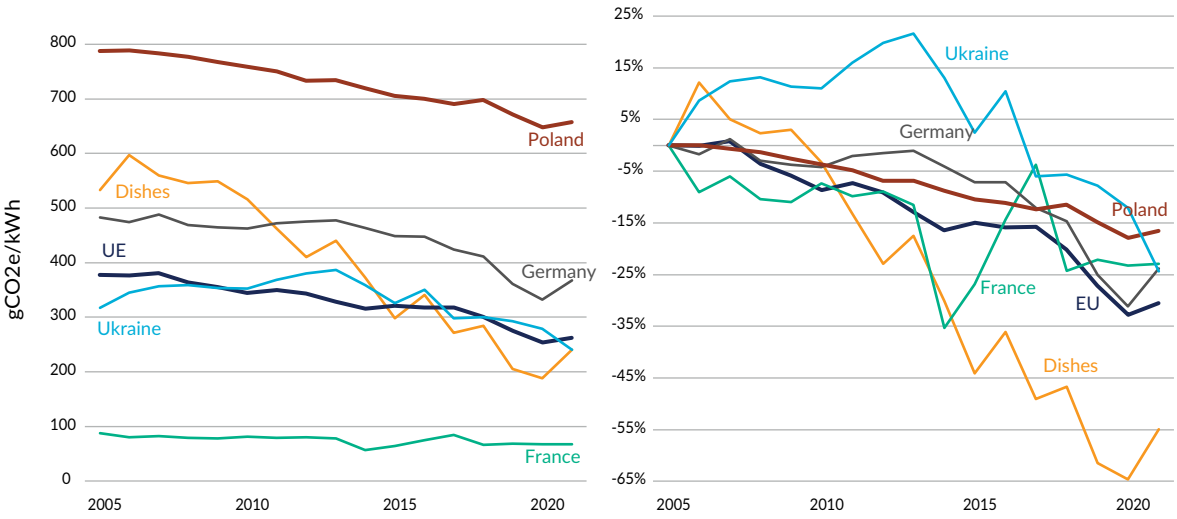
from electricity consumption), which in turn negatively affects the competitiveness of producers. Reducing emissions and striving for climate neutrality are therefore not goals in themselves, but actions necessary to maintain the long-term health of the Polish economy.

The Russian invasion of Ukraine caused a reorientation of energy policy in most EU countries, especially in the context of fossil fuel imports. Poland took care to diversify its sources of imports of these raw materials in order to become independent from Russian supplies. In addition, even before the Russian invasion, Polish decision-makers took care to develop gas and oil infrastructure, resulting in the Baltic Pipe pipeline and a gas pipeline connecting Poland and Slovakia being launched at the end of 2022, and an oil terminal in Gdansk being put into operation in 2021. However, unlike many other EU countries, Poland has not initiated a policy to promote energy conservation. Many member states, e.g. the Czech Republic, Germany, Spain, have set temperature limits for heating and air-conditioning in public buildings. Many EU countries have also run campaigns to promote energy conservation. However, the biggest discrepancy between Poland and the rest of the EU countries can be observed in the issue of support (or more precisely, the lack of it) for RES development. While they have taken measures to accelerate the development of renewable sources (e.g. Italy has simplified the procedure for issuing permits for the construction of photovoltaic and wind farms, Denmark has accelerated the construction of new wind farms), Poland has still not only failed to support the development of RES to a sufficient extent, but has also failed to remove the biggest existing barrier for them, the 10H rule. The liberalisation of this law has been set as one of the milestones the Polish government has to meet in order to receive the first part of the National Reconstruction Plan funds from the EU. This prompted policymakers to resume work on amending the law at the end of 2022, and in January 2023, the draft amendment was being processed in the Sejm's Committee on Energy, Climate and State Assets. In addition, Prime Minister Mateusz Morawiecki announced an update of Poland's Energy Policy until 2040 for mid-2023, which means that significant changes to the development of RES may appear then.

Poland needs to catch up, but it can benefit from its *late adopter* (*laggard*) approach by applying best practices that have worked in other countries, as well as avoiding their mistakes. Examples are the legislation on the auction system or the power market, which was modelled on the solution used in the UK. Poland can look at countries such as Spain or Denmark, which are pioneers in the integration of RES variables (which is also due to their geographical conditions and infrastructure). The example of Denmark shows the importance of high-capacity cross-border connections (in this case with Norway, whose system is based on hydroelectric power plants, so it is able to balance the grid efficiently). In 2020, Denmark was a net importer from Norway (8.3 TWh) and a net exporter to Germany (7.5 TWh), with an annual electricity demand of 34 TWh and net imports of 6.1 TWh[11].

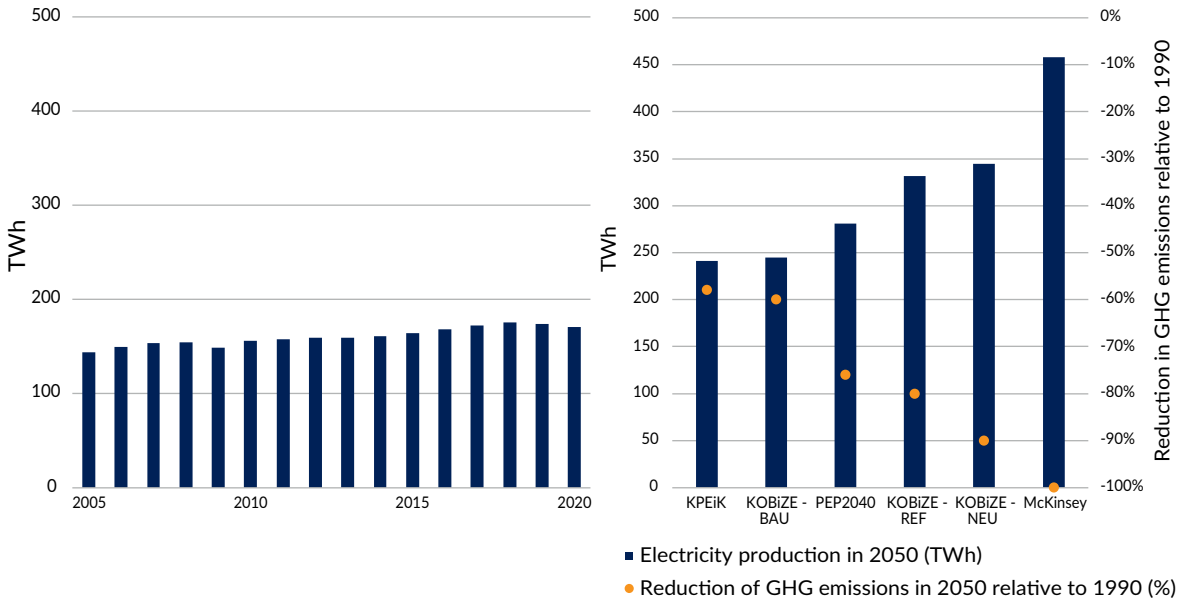
11 Danish Utility Regulator, *The Danish Electricity and Natural Gas Markets 2020*, 2021, https://www.ceer.eu/documents/104400/7169677/C21_NR_Denmark_EN_Summary/75bc9f41-1b9f-8096-ac0a-4d35a3ea07c4

Figure 3 and 4: GHG emission intensity index in electricity production in Poland and example countries from 2005 to 2020



Source: Own elaboration based on Ember data

Figure 5 and 6. Electricity consumption in Poland 2005-2020; Projections of electricity generation and GHG emission reductions in Poland in 2050



Source: Historical data - KOBiZE; forecasts - according to the legend

3. RES as a key element of a decarbonised energy system

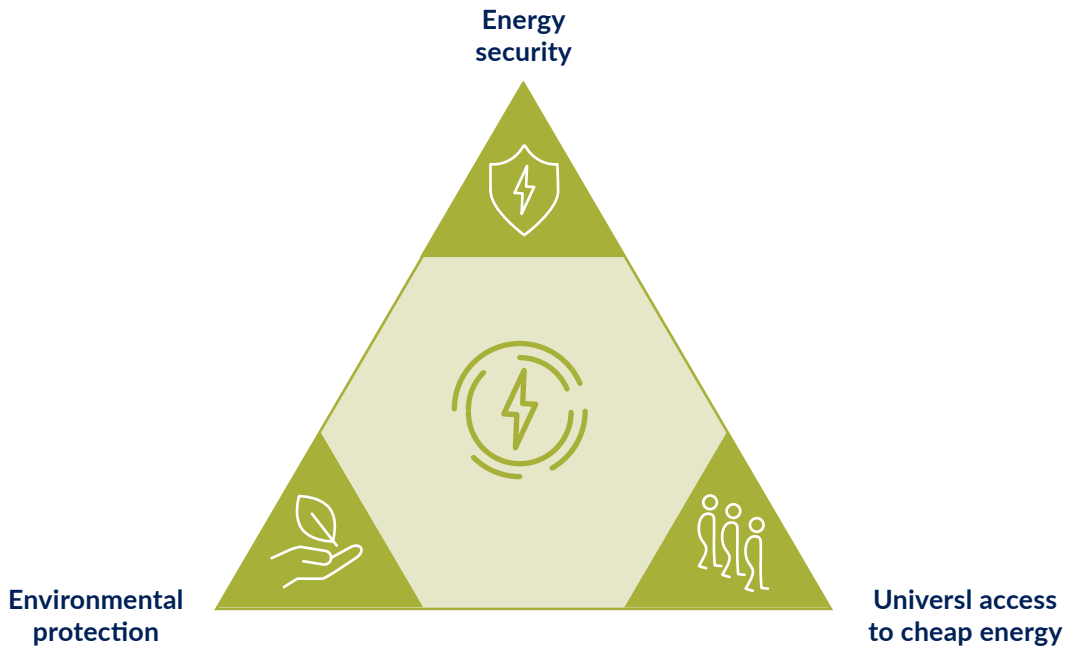
A closer look at the challenges facing Poland and the course of the energy transition in other countries to date shows that a number of factors influence its direction. Firstly, Poland has committed itself to climate and environmental targets internationally (Paris Agreement) as well as legally at the European Union level. This means that Poland must reduce greenhouse gas emissions in all sectors of the economy.

Secondly, the reduction of greenhouse gas emissions is linked to the electrification of other areas of the economy, such as transport, heating and partly industry. These activities will lead to the need for a rapid increase in the installed capacity of the system in order to cover the growing demand for energy. Poland will not only have to replace its current generation fleet, but, according to various forecasts, more than double it.

Thirdly, Poland must ensure its security and energy independence. Due to limited economically recoverable fossil fuel resources, Poland needs to become independent from them in the long term. This problem has become particularly important after Russia's full-scale attack on Ukraine, the consequence of which was a reduction in the supply of energy carriers from Russia to Poland and Europe and an energy crisis. In addition, Poland and the countries of Europe must protect their citizens and the competitiveness of their economies by ensuring their continued access to affordable energy. All these contexts: environmental, climatic, political, geopolitical, geographical, economic and social create boundary conditions for the energy transition.

The need to find trade-offs has been conceptualised by the World Energy Council as the energy trilemma, which distinguishes three areas: energy security, environmental protection and universal access to affordable energy. As the authors point out, properly balancing these during the transition (ultimately achieving a high level of fulfilment of each) involves multi-level cooperation between public and private actors, governments, regulators and consumers, as well as balancing economic and social factors, national resources and environmental concerns. Often, actions that support one area have a negative impact on the others, and the multiplicity of solutions and variables makes a holistic assessment difficult.

Diagram 2: The energy trilemma



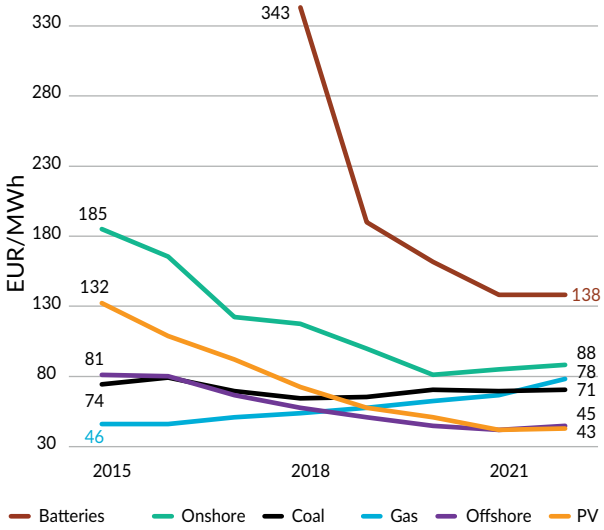
Source: Own elaboration based on World Energy Council[12]

The characteristics of renewable energy sources fit into the country's sustainable development perspective. They are low-carbon sources that also represent the cheapest solution on the market in terms of the levelised cost of electricity (Figure 7). In addition, the production of electricity from RES does not require fuel, contributing to a reduction in the consumption of fossil raw materials and therefore their import. Due to their modularity and mass production capabilities, they can be developed and controlled by a diverse group of investors, thus democratising the energy sector and enabling a wider range of individuals, communities and small businesses to access energy.

Renewable energy sources are not without their disadvantages, which will pose challenges in terms of their proliferation, and these include the variable production of energy from these sources, the use of land or the consumption of critical materials needed to produce them. However, the benefits far outweigh any disadvantages. These challenges and trade-offs will require the elimination, or minimisation, of their negative impacts through appropriate transition management. By investing in RES and developing a low-carbon economy, Poland can become less dependent on fossil fuels, strengthen energy security and boost economic growth.

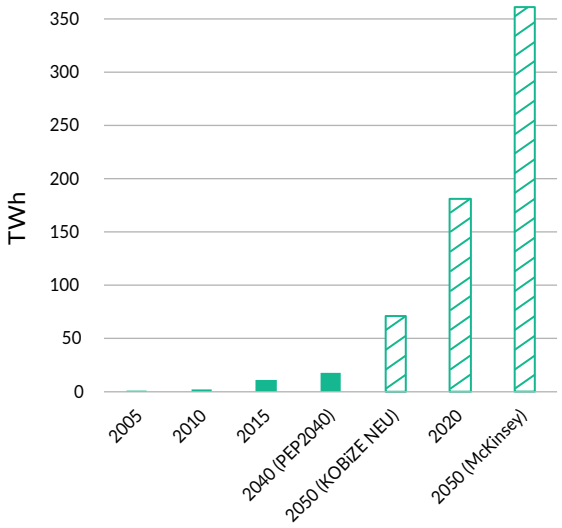
12 https://www.worldenergy.org/publications/entry/world-energy-trilemma-index-2019

Figure 7 and 8: Levelised cost of electricity (LCOE) [EUR/MWh] for individual carriers from 2015 to 2022



Source: BloombergNEF

Wind and solar production from 2005 to 2020 and projected production volumes from these sources for 2040 and 2050

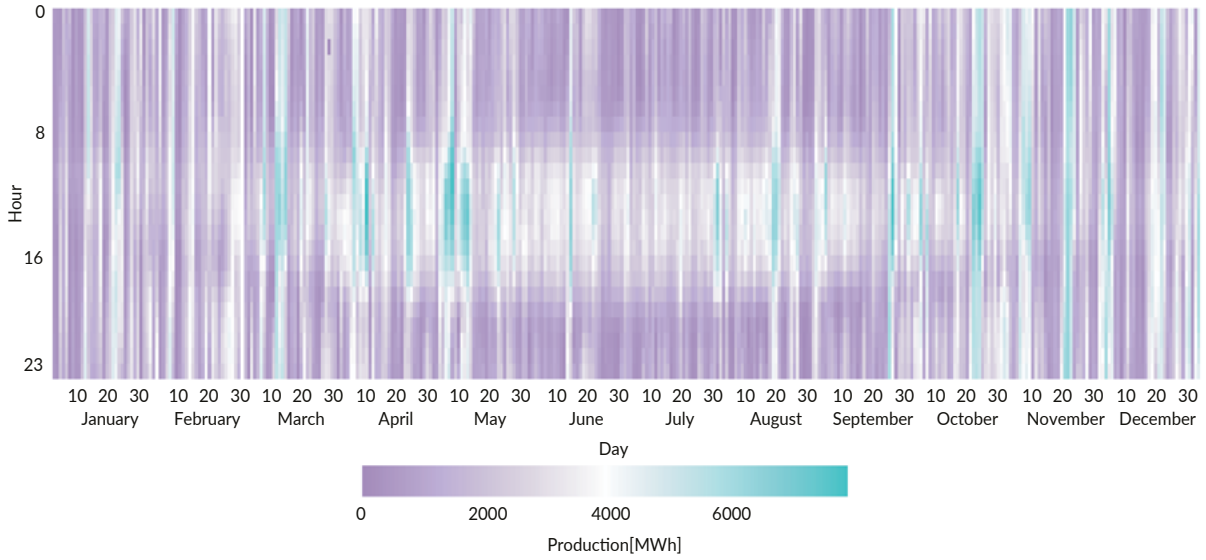


Source: Instrat, PEP2040, KOBiZE, McKinsey

4. Variable production from renewable energy sources

The current power system has been built around centralised power generation in conventional units, i.e. based on the combustion of fuels and providing the theoretical possibility of continuous energy production with capacity control. This allows production to be adapted to rigid demand, providing energy *on-demand*. In this paradigm, energy flowed from large conventional units towards consumers. The increasing contribution of wind and solar sources, with their vastly different, variable and non-dispatchable power generation characteristics, will require the energy system to be remodelled and, in many areas, reinvented. Renewables will also be more distributed. Much of the generation will also take place at the low-voltage level of the distribution networks, which will require their expansion and adaptation. The variability of generation and decentralisation means that the system will be more dynamic and energy will flow in both directions. It will also result in greater regionalisation and fragmentation of the electricity network.

Figure 9: Electricity production from wind and solar sources by hour in Poland in 2021



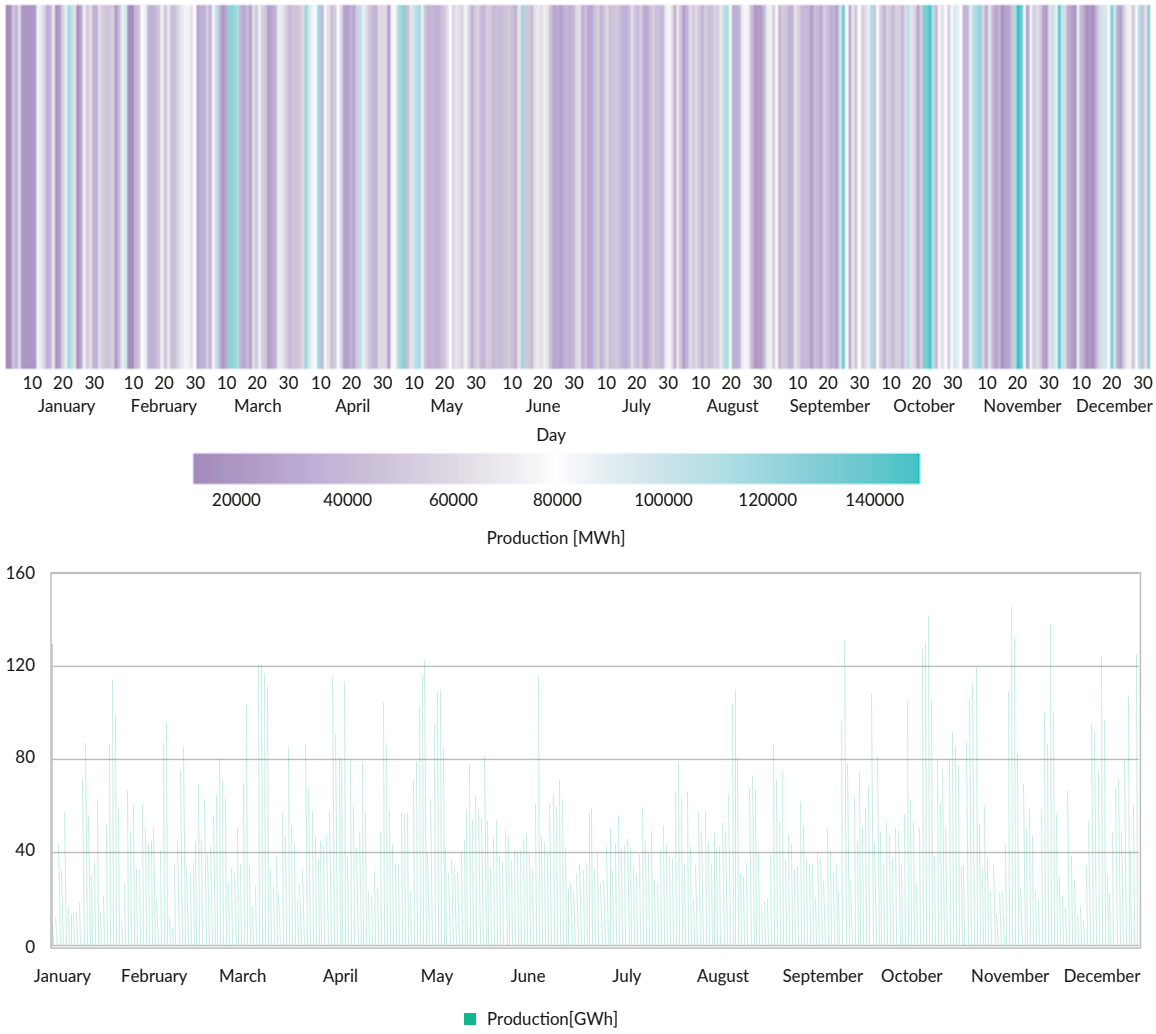
Source: Own elaboration based on ENTSO-E data

Figure 9 shows the total generation from wind and solar sources at each hour in 2021. The graph shows the differences in generation from these sources both on a daily and seasonal basis. The warm months are dominated by relatively systematic generation from solar sources, supported at certain times by good wind conditions. This results in large diurnal variations. In contrast, during the cooler months, production is dominated by wind, which tends to have a less variable diurnal profile, but there are also windless periods.

A study based on the analysis of hourly generation data from wind and solar sources[13] indicates that adequate scaling of renewables together with relatively small storage potential (e.g. 12h) will be sufficient to meet demand for most of the year. The key in diurnal balancing will therefore be energy storage following renewable generation and a demand side response to reduce peak demand. The study did not consider the economic aspects of such solutions.

Longer periods of reduced generation from the sun and wind appear to be more problematic. *Dunkelflaute* are periods of time when, due to a lack of wind and sunlight, little or no energy can be produced from these sources. In such situations, other sources of energy, such as coal, gas, nuclear or hydroelectric power plants, are usually used to ensure continuity of supply.

Figure 10 and 11: Electricity production from wind and solar sources on a daily basis in Poland in 2021



Source: Own elaboration based on ENTSO-E data

13 Dan Tong et al, *Geophysical constraints on the reliability of solar and wind power worldwide*, *Nature Communications* 12, no. 6146 (2021). https://doi.org/10.1038/s41467-021-26355-z .

In Figure 10, which shows the average daily generation from renewable sources (wind and solar) on each day in 2021, the dark bars indicate periods with low generation from these sources. Such periods occur more frequently in the winter months, due to the less systematic nature of the wind and reduced generation from PV.

Dunkelflaute usually lasts up to a few days, but in extreme cases it can last up to two weeks, and periods of reduced generation can extend over several weeks. Optimisation studies based on 35 years of historical data indicate that, in the case of Germany, 56 TWh of energy (of which 54 TWh in hydrogen, translating into 36 TWh of electricity) would be needed for an annual electricity demand of 540 TWh (and thus just under 7% of annual demand) to ensure uninterrupted operation of a 100% RES system during extreme periods of *dunkelflaute*. The authors indicate that the amount of hydrogen needed would fit into the German caverns where natural gas is now stored[14].

Securing the supply of electricity during this period will therefore require measures of a different scale than balancing during the daily period. In the case of interruptions of several days, but also rare periods of relatively reduced production that may extend over several weeks, a combination of all solutions will be needed to ensure not only sufficient energy but also power: including low-carbon energy sources, storage and adequate strategic/critical reserve. The latter is particularly important during the transition period, when closing the system during these infrequent periods will be a large part of the cost of transforming the sector and significantly scaling current storage capacity.

14 O. Ruhnau, S. Qvist, *Storage requirements in a 100% renewable electricity system: extreme events and inter-annual variability*, *Environmental Research Letters* 17, no. 4 (2022). DOI: 10.1088/1748-9326/ac4dc8 .

5. How to support the development of a sustainable electricity system?

As we pointed out above, due to the two main factors associated with the proliferation of renewables: the variability of production and the dispersion of generation, the electricity industry will evolve towards more complex, more dynamic systems, also in terms of the interaction of consumers with the system.

In this context, the energy transition process is often over-simplified or succumbs to single-cause thinking, while the electricity industry is evolving in a more complex direction. Therefore, building a new system - based on renewables - requires a holistic approach, without over-reducing it to its individual components.

Renewable energy sources, which will form the foundation of the system, require completely different legislative and infrastructural conditions than the conventional power plants on which the Polish electricity system has so far been based. Increasing the role of RES in energy production will require solutions supporting real-time balancing, as well as ensuring adequate redundancy during longer periods of reduced generation from these sources. In addition to the **development of new generation resources** (wind farms, photovoltaic installations, low-carbon dispatchable sources, etc.), a number of other investments will be needed. Changes in the state's energy and climate policy paradigm are also required[15], followed by legislative changes that will create conditions conducive to the development of low-carbon energy production and investment in the technologies and solutions needed to integrate RES into the grid. A key difference between a centrally controlled system and one based on distributed renewables is the need for **flexibility**. In an energy system, flexibility refers to the ability to balance supply and demand in the face of changing availability and prices of energy from given sources (e.g. due to weather conditions unfavourable to RES generation). With the spread of renewable sources, the dispersion of generation resources (**decentralisation**), regionalisation and generation at distribution network level will increase.

In the tables below, we indicate actions that can be taken by the Polish state which, at the system level, will help to create a new energy system based mainly on generation from renewable sources. In Tables 1, 2 and 3, we have presented the main elements of such a system, together with recommendations for specific policies.

15 We elaborated on the issue of competition in the energy market in a previous report: *New paradigm. Why does the energy industry need competition?*

Diagram 3. The three dimensions of a climate-neutral electricity system

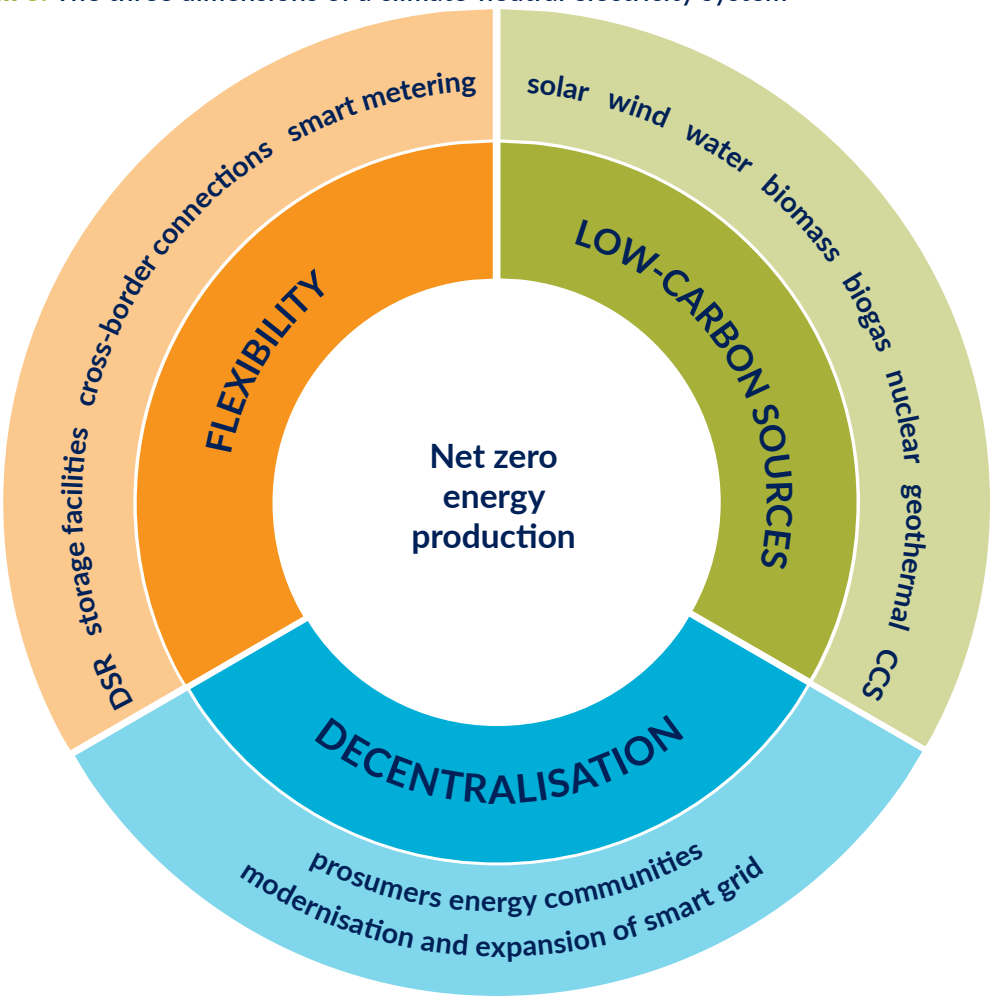


Table 1. Policies supporting low-carbon energy sources

Low carbon energy sources

Increasing the share of electricity in final energy consumption will require not only decarbonisation of the current generation fleet, but also investment in its expansion. It is essential to develop generation resources for solar and wind (both micro, small and large scale), as well as low-carbon dispatchable sources that make the system stable and balanced while keeping its carbon footprint low. A properly secured system should also have sufficiently large strategic reserves.

Area	Description	Current state	Recommendation/ Assessment
Renewable energy sources (wind and solar)	The development of RES makes it possible to increase the independence of the Polish economy from fossil fuels, and to ultimately become completely independent of them.	Poland has support systems in place for RES power generators: 1. **Green certificates** - RES generators can increase profits by selling certificates to other energy companies 2. **RES and off-shore auction system** - give RES generators a guaranteed income and promote market competitiveness However, ‚My Current', a subsidy programme for PV micro-installations and energy storage, and net-metering, which is favourable to prosumers, are responsible for the vast majority of the increase in RES capacity. In 2022, this has been replaced by the long-term less favourable net-billing from the prosumer's point of view.	At present, the biggest problem is the regulations inhibiting or limiting the development of RES and private investment in these sources. The strong oligopoly of state-owned energy companies makes it profitable for them to maintain *the status quo*, which results in their low participation in the decarbonisation of the Polish electricity sector, thus holding back the Polish transformation. Prices for wind and solar energy are low enough that these technologies can already compete on a market basis, without public support (through the cPPA formula) or with minimal support (prosumers, energy communities). What is needed, therefore, is first and foremost: opening up the market to new investments, breaking the oligopoly of state-owned companies and proper management of grid expansion. The most important actions required include: 1. **Liberalisation of the 10H rule to allow investment in onshore wind power.** 2. **Simplification of procedures related to investments in renewable sources (e.g. spatial planning or environmental impact assessment).** 3. **Increasing the transparency of distribution network expansion plans and decisions on issuing connection conditions, and increasing the capacity of these networks.**

			4. **Unlocking competition by removing barriers to cPPAs** - although cPPAs are possible, there is a lack of dedicated regulation to remove barriers to their development. Factors blocking the potential of cPPAs include the high volumes offered under contracts (discouraging those with low demand), the length of contracts, the complexity of the negotiation process and the lack of direct lines. Contracting has also been hampered by the removal of the exchange obligation, which has reduced market transparency[16] . 5. **Supporting access to green energy for SMEs (cPPAs, own sources).** 6. **Further support for prosumers and building an enabling regulatory environment for energy communities** (more in Table 3).
Low-carbon dispatchable sources (nuclear, hydropower, biomass, biogas, geothermal, power plants with CCS)	Low-carbon dispatchable sources are crucial due to the intermittent nature of production from solar and wind sources - in contrast, they provide the technical ability to produce energy continuously with controllable output, so they are a guarantee of energy supply when RES generation is too low.	A capacity market has been implemented in Poland, which also provides support for low-carbon sources, but the results of the capacity market auctions so far have been dominated by emission sources. Support for biomass and biogas sources is possible under the auction system, and a FiT/FiP support system for small biogas plants and hydropower plants has also been launched. An auction system has also been implemented in Poland to support high-efficiency cogeneration, which, despite its reliance on fossil fuels, is much more efficient. In addition, the National Fund for Environmental Protection and Water Management (NFOŚiGW) runs programmes to support low-carbon energy production. In addition, work is underway to implement the country's nuclear power programme, with a target of 6-9 GW of nuclear capacity.	Given the scale of the challenge of balancing a RES-based system, the need for adequate reserves and the scale of investment required, the following actions are required: 1. **Reform of the power market** to give greater support to low-carbon sources by introducing stricter environmental (emissions) criteria. 2. **Policies (including support instruments) to further exploit the potential of other dispatchable sources, such as sustainable bioenergy.** Support schemes for the development of low-carbon controllable sources are in place (e.g. under NFOŚiGW programmes), but it should be stressed that these programmes are mostly financed by EU funds, under e.g. the Modernisation Fund, whose funds are marked – they cannot be transferred for another purpose.

16 We describe these issues in more detail in our series of reports on cPPAs, and the legislative barriers associated with them in *Niewykorzystany potencjał umów cPPA. Przegląd barier regulacyjnych i rynkowych.*

			Poland should also provide national funds to support these sources, e.g. through the Energy Transformation Fund. Poland can also exploit the potential of hydro sources by using existing hydro dams[17].
Strategic reserve	A strategic reserve serves to strengthen the system's resilience to periods of *dunkelflaute* by securing supply.	At present, the role of reserve and system-closing technology is fulfilled by fossil fuel power plants (coal and gas-fired), especially coal-fired plants, which are required to stockpile fuel. Maintaining emission-intensive sources, whose profitability falls with rising fuel prices and the price of emission allowances, is supported by the capacity market. The government also plans to establish a National Energy Security Agency (NABE), which would bring together coal assets from Polish state-owned companies.	In a decarbonising system, this reserve will increasingly be made up of controllable low-carbon sources and energy storage, so their support within, for example, the existing capacity market is crucial. It should also be borne in mind that dispersal and increased cross-border connectivity reduces the effects of *dunkelflaute* 1. When NABE is formed, **a pathway to closing down coal-fired power plants should be established**, while maintaining the required strategic reserve to ensure security and stability of energy supply[18] . 2. **Forecasting should be used to predict longer periods of *dunkelflaute***, in order to best prepare the system for such events.

17 For more on the potential and legislative barriers to hydropower in Poland, see the UN Global Compact report: *Small hydropower plants in Poland*.

18 We discussed these issues in more detail in our publications *Coal's Swan Song* and *The New Paradigm*.

Table 2. Policies supporting the flexibility pillar in the energy system

Flexibility

Increased flexibility on both sides will be one of the pillars of energy systems based on variable RES. Flexible generation sources and energy storage will allow to follow variable RES generation, while demand-side measures can reduce or shift demand over time to close the balance of the system. Optimally, the system should evolve towards flexibility services that are as convenient as possible and even invisible to the consumer (such as controlling a heat pump, charging a car or switching on appliances such as air conditioning or washing machines). On the other hand, at the time of the energy transition, active demand-side services (such as DSR) will be key, due to the effect of reducing the need for additional investment and fixed costs for infrastructure and enabling the electricity system to be kept in balance in emergency situations. The increasing share of renewable sources will also require accurate and reliable forecasting of electricity production from wind and solar sources. The accuracy of these forecasts affects system operation (need for real-time balancing) as well as action planning (bottleneck management, strategic curtailment, DSM, reserve planning).

Area	Description	Current state	Recommendation/ Assessment
Demand Side Response (DSR)	When designing a RES-based system, it is crucial to view demand-side management tools as equivalent to generation itself. DSR is a mechanism that allows the demand side to respond (reduce demand) to balance the grid and reduce costs, in return for remuneration. The key benefits of DSR include: • flattening the daily power demand curve in order to avoid situations of peak demand in the system with the risk of *rolling blackouts* • optimising energy demand profiles, not only by reducing, but also by maximising consumption during the period of the most favourable energy prices (assuming that the dynamic tariff mechanism is in place).	DSR in the form of peak load curtailment services is currently supported by capacity market auctions. These services are usually provided by large entities (e.g. industrial plants) contracted by so-called aggregators (e.g. Enel X). This type of service provides remuneration for the declared willingness to reduce electricity consumption in a peak demand situation in the system. There is also an Intervention Intake Reduction Programme, but its popularity is much reduced as it does not offer a fixed remuneration - you only receive it for the reduction you make. At the end of 2022, PSE started reporting peak demand hours on its website and announced work on a dedicated app. However, the effectiveness of this type of solution in reaching a sufficient number of consumers is questionable unless it is accompanied by an appropriate campaign to promote energy conservation at specific times.	Although DSR is already part of the Polish energy system, its potential remains largely untapped. It is estimated that DSR can cover up to 10-15% of the system's peak energy demand[19]. In order to maximise the potential of DSR, it is essential to: 1. **Further support through power market auctions.** 2. **Develop DSR programmes**, including by raising awareness of its benefits among consumers. 3. **Enable the participation of consumers and aggregators in the energy and balancing market.** 4. **Introduce an effective and widespread system to notify consumers of peak demand periods on the system in order to encourage them to save energy, e.g. along the lines of California's 'Flex Alert'** - the key in the context of such a tool will be to explore how to optimise its operation. 5. **Increase in self-consumption** resulting, for example, from incentives from an appropriate billing architecture (for energy communities, prosumers).

19 Policy Insight, Enel X, *The awakening of flexible capacity, or how DSR can enhance Poland's energy security*, 2022.

Energy storage (pumped storage, chemical batteries, hydrogen)	Energy storage facilities allow for the accumulation of energy created when there is an existing surplus during periods of cheap energy and guarantee its supply at times of shortage in generation. Their most important functions include: • real-time and daily balancing of the system at national as well as local level, due to the daily variability of RES generation (e.g. rotating masses, battery storage) • Seasonal balancing of the system in the event of prolonged shortfalls in wind and solar power (hydrogen, biofuels, heat storage, large ESP).	The regulatory basis for their development (definition of energy storage and rules for connecting storage to the grid) has been introduced into national law, facilitating the development of storage in Poland. Energy storages can be supported within the framework of power market auctions and the 'My Electricity' programme, under which it is possible to receive co-financing for household storages. In November 2022, a draft of a new law on investments in pumped storage power plants was published, which will create a legislative and administrative environment for the construction of new ESPs. According to the plans of the Ministry of Climate and Environment (MKiŚ), 9-10 new power plants of this type with a total capacity of 5.5-6 GW are to be built in Poland by the mid-2030s[20].	Although regulations dedicated to energy storage have been emerging recently, the demand for it is also growing rapidly. As a result, the following actions are key: 1. **Consistent implementation of planned investments in pumped storage power plants** - ESP investments require a lot of money and careful planning. 2. **Increasing investment support for domestic energy storage under the 'My Electricity' programme.** 3. **Promoting energy storage among prosumers through education and information campaigns on the role of storage in RES generation.** 4. **Support for storage at the distribution network level through investment and the use of *nodal pricing*** - price signals can motivate investment in storage in areas with high energy prices. 5. **Billing incentives for the consumption of own produced energy dedicated to energy communities.** 6. **Investment support for hydrogen and biofuel energy storage technologies.**

20 *Draft Law on Preparation and Implementation of Investments in Pumped Storage Power Plants and Associated Investments*, Government Legislation Centre, 3 November 2022, https://legislacja.rcl.gov.pl/projekt/12365909/katalog/12924367#12924367 .

Cross-border connections	Interconnecting Poland's energy system with others will increase resilience in the context of periods without wind and solar, provide the possibility to export surplus energy from RES and increase security of supply in emergency situations or insufficient reserves.	The EU target for 2030 is to be able to transmit min. 15% of the electricity produced across national borders[21]. Poland formulates its objectives for the development of cross-border interconnections on the basis of EU objectives and strategies defined by European experts - e.g. within the framework of the Ten-Year Network Development Plans drawn up by the European Networks of Transmission System Operators (ENTSO-E). Poland is also fulfilling its obligations to develop cross-border connections resulting from the integration of markets at EU level. In 2020, the IEA published the 'Polish Implementation Plan', which set targets for increasing cross-border electricity exchange through grid expansion. According to the 2021 report, these investments should be completed in 2024[22]. The Polish Transmission System Operator is planning further expansion of cross-border interconnections - the framework for these investments is set out in the ‚Development Plan for Meeting Current and Future Electricity Demand for 2023-2032'.	Current cross-border connection capacities are below the EU average. The current version of the NAPE lacks a target related to the expansion of cross-border connections. According to PSE's plans, Poland has a plan to expand these connections, but needs to take action to set binding targets in line with EU targets. Such action will oblige the government to meet these targets. Rebuilding the capacity of connections with Ukraine has also become a new priority.

21 *Electricity interconnection targets*, *Energy - European Commission*, accessed 26 January 2023, https://energy.ec.europa.eu/topics/infrastructure/electricity-interconnection-targets_en .

22 *Report on the Implementation Plan for Electricity Market Reforms Adopted by the NPS*, Ministry of Climate and Environment, 19.10.2021, https://www.gov.pl/web/klimat/sprawozdanie-z-realizacji-planu-wdrazania-reform-rynku-energii-elektrycznej-przyjete-przez-kse .

Smart metering of energy consumption	Remote reading meters enable real-time monitoring of energy consumption, thus supporting both consumers and suppliers in making more informed decisions. With real-time monitoring, these meters: • enable suppliers to gain a more accurate understanding of energy consumption patterns in order to better manage the network (e.g. prevent supply interruptions) • promote an overall reduction in energy demand (permanent destruction) • allow the introduction of dynamic tariffs, billing for prosumers and energy communities and the provision of system services • reduce operating costs through the possibility of remote reading.	As part of smart grid development, PEP2040 assumes that 80% of households will be equipped with remote reading meters by 2028. Poland's actions are based on the EU's strategy in this regard, albeit delayed - the EU target was for 80% implementation by 2020. As part of the Modernisation Fund, a programme of subsidies for remote reading meters, 'Electricity - Smart Energy Infrastructure', is being implemented. In 2021, around 15% of households will have smart meters[23].	1. **Consistent replacement of meters with smart meters** according to the timetable developed by the IOC in 2021 to ensure that the target set is met. 2. **Investment support for projects testing the integration of remote sensing technologies for electricity consumption with other technologies that will be part of the energy system and economy (V2P, heat pumps, energy storage, etc.)** - this type of funding can be transferred to local pilot schemes, e.g. at the level of municipalities or energy communities.
Dynamic electricity tariffs	Dynamic tariffs are a tool for managing electricity demand - its prices can change due to demand, supply or other factors. Dynamic tariffs serve to stabilise the network by flattening the daily demand curve and also encourage energy conservation by consumers. There are three types of this type of tariff: 1. ***Time-of-use pricing*** - prices are set based on the customer's consumption profile. 2. ***Critical peak pricing*** - higher energy rates apply during periods of peak demand. 3. ***Real-time pricing*** - prices vary depending on the time of day and can also be linked to the next day's market.	Companies in Poland can benefit from flexible energy purchase settlement models. Entrepreneurs can choose to purchase in tranches (based on the company's consumption profile) or based on the average price from stock exchange quotations (based on a calculated price trend for the period of signing the contract). Currently, there are no dynamic tariff mechanisms in place for residential customers in Poland, although there have been recent such proposals from the Ministry of Climate and Environment.	1. **Implement a transparent and non-discriminatory system of dynamic tariffs for residential customers**, based on a thorough analysis of the possible impacts and including mechanisms to protect vulnerable customers. 2. **Further development of smart metering and *smart grid* solutions** necessary for the introduction of dynamic tariffs.

23 European Union Agency for the Cooperation of Energy Regulators, Council of European Energy Regulators, *Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2021*, October 2022, https://www.acer.europa.eu/sites/default/files/documents/Publications/MMR_2021_Energy_Retail_Consumer_Protection_Volume.pdf.

Oversizing/ curtailment	Scaling up is the expansion of generation resources beyond the estimated demand. Unlike conventional sources, RES do not require fuel and the cost of investment decreases year on year. This makes it cost-effective to scale up the resources under construction to ensure the highest possible level of generation, even at the expense of ‚wasting' energy during periods of oversupply on the grid. Analyses show that controlled curtailment can in some cases be more cost-effective than, for example, energy storage.	In Poland, the need to curtail RES generation is rarely yet (although increasingly) being raised due to the relatively small generation resources from wind and solar. Shutting down windmills is also a balancing method that PSE resorts to as a last resort, after, among other things, it has ordered coal and gas-fired power plants to reduce capacity. Power producers are then entitled to compensation. In Poland, however, there is also uncontrolled *congestion* at distribution network level resulting from locally occurring bottlenecks. The restriction also takes the form of refusals to issue grid connection conditions for PV installations due to (as most often cited by operators) a lack of available connection capacity.	1. **Extension and upgrading of the network to enable efficient connection of new installations and avoid the appearance of bottlenecks in the network.** 2. **Monitoring and analysis of uncontrolled reduction in production for effective management.** 3. **Introducing *nodal pricing* as a tool to prevent energy waste -** nodal prices are defined on the basis of current consumption in the area of a given network node, providing a price incentive to save energy during periods of increased demand in a given area.

Table 3. Policies supporting the decentralisation pillar in the energy system

Decentralisation

Decentralisation is a natural direction for RES-based system development, as they do not require centralised and large-scale technical infrastructure. In particular, photovoltaics, of which prosumer rooftop or ground-mounted micro-installations are the most popular form in Poland, allow for a high degree of source dispersion and reduced land use. Many decentralisation measures support the democratisation of energy, i.e. giving citizens the opportunity to actively participate in the operation of the energy system, allowing greater control over our interaction with the system. Decentralisation also supports the creation of a resilient and secure energy system, by dispersing energy sources and reducing vulnerability to failures and unexpected events (such as large-scale block failure, fossil fuel supply constraints). More sources at the distribution network level need to be upgraded and expanded. Measures are needed to strengthen local production, storage and consumption of energy so as to prevent uncontrolled curtailment of production, overloading of the grid and waste of energy.

Area	Description	Current state	Recommendation/ Assessment
Prosumers (single-family homes, collective prosumption, public buildings, companies)	Prosumers, i.e. energy producers and consumers at the same time, will be one of the most important elements of the new energy system. Currently, these are mainly households that install photovoltaic panels on their roof or property. This allows them to increase the amount of renewables in the system, but also to consume energy locally. The panels can work with a heat pump and energy storage to create a zero-carbon, self-sufficient energy building.	The 'My Electricity' programme is one of the main prosumer support mechanisms under which it is possible to receive funding for PV and/or energy storage installations. In recent years, the regulatory environment for the development of prosumerism in Poland has been gradually built up. As part of the amendment to the RES Act in 2021, the terms **virtual prosumer**, **collective prosumer** and prosumer **representative** were introduced into law. At the end of 2022, the institution of the **prosumer tenant**, a solution to promote PV installations in housing cooperatives and communities, was introduced. In 2022, the billing rules for prosumers were changed from net-metering to net-billing, which is less favourable from their perspective in the long term.	The launch of the 'My Electricity' programme and favourable net-metering have resulted in an intensive development of prosumer installations, which account for the vast majority of the growth in RES capacity in recent years. The change in billing rules in April 2022 has put the brakes on this growth. The recent changes to the 'My Electricity' programme, which introduced a subsidy for energy storage and subsequently increased the size of the storage subsidy, is an important measure that could increase the popularity of these solutions. What is missing, however, is an information campaign that clearly and transparently communicates the advantages of integrating PV installations with backyard energy storage. Among other things, it should be clearly communicated that hourly billing and energy price cannibalisation (*value deflation*) from PV installations will make energy storage even more cost-effective. As more PV installations are built, the average wholesale price of the energy they produce will fall during high generation hours, making energy storage more attractive.

Energy communities[24]	Energy communities (ECs) are a group of individuals, households, or entities that collectively manage local energy production and consumption. They are one of the most comprehensive solutions as they fulfil environmental, social and energy security objectives.	Polish law distinguishes three different types of ECs: **energy cooperative**, **energy cluster** and **renewable energy collective prosumer**. The strongest contribution to the development of ECs came from the 2016 amendment to the RES Act, which introduced the concept of an 'energy cluster'. In turn, the following amendments to the RES Act were proposed in 2022: 1. A new definition of the energy cluster that would take into account its objective of providing environmental, economic and social benefits (relevant in the context of the transposition of the EU EC provisions). 2. Maintenance of the EC register by the ERO. 3. Exemption from distribution and other charges related to the energy generated. From 25 January 2023, energy cooperatives and farmers can apply for funding under the **Rural Energy** Programme[25].	Although the pending draft amendment to the RES Act significantly improves the conditions for the development of energy clusters, there is still a lack of clear incentives for energy communities. In order to further develop this type of community in Poland, stronger investment, administrative and technical support will be necessary. In order for energy communities to become one of the pillars of a decentralised electricity system, it is necessary to: 1. **Introduce an incentive scheme for ECs, especially in the context of tackling fuel poverty** (this is one of the targets set for ECs at EU level). 2. **Set parameterised targets for EC development in Poland and monitor their implementation.** 3. **Empower ECs to work with DSOs** to facilitate grid connection approvals, better exchange of information and facilitate the provision of flexibility services by ECs[26].

24 We covered the topic of energy communities in more detail in our report *Best practices for energy communities in Poland and Germany.*

25 *Energy for the countryside*, Ministry of Agriculture and Rural Development, accessed 26.01.2023, https://www.gov.pl/web/rolnictwo/energia-dla-wsi.

26 For more on recommendations for the development of energy communities, see our report: Iwona Ciećwierz et al, *Best practices for energy communities in Poland and Germany*, WiseEuropa, 2022, https://wise-europa.eu/wp-content/uploads/2022/11/ANALYSIS_Best_practices_for_energy_communities_in_Poland_and_Germany_Pol.pdf.

Expansion and modernisation of distribution networks	The progressive decentralisation of generation resources due to the increasing role of RES requires the expansion of the distribution network for the efficient integration of distributed sources (solar panels and windmills). Expanding and upgrading the network would also allow for increased capacity, which is crucial in the context of electrification of transport and individual heating.	The scale and pace of grid expansion and modernisation has so far been insufficient, a telling example of which is the number of refusals to issue grid connection conditions - in 2021 alone, these refusals covered installations (mainly RES) with a total capacity of around 15 GW. In November 2022, the largest distribution system operators signed **the Charter for the Effective Transformation of the Distribution Networks of the Polish Power Industry** (hereinafter Charter) to ensure a stable regulatory environment for network development and to support investments in this area. Expenditure of PLN 52 billion is planned until 2025.	The signing of the Charter is an important step to systematise action. The increasing role of distribution network operators will require both investment and new management models, increasing self-consumption and balancing the network at local level, which will reduce the costs associated with network expansion. Therefore, the following actions should be taken to this end: 1. Realising distribution tariffs taking into account the progressive decentralisation of generation resources and the increasing share of RES on energy distributors and the investments needed (in line with the Charter). 2. Measures that reduce the need for investment: support for self-consumption and balancing by promoting local/home energy storage, investment support and development of models such as prosumers, energy communities or virtual power plants, changes in the functioning of the energy market (local pricing). 3. Increase transparency in distribution network planning, including by setting quantifiable targets and separating distribution from companies.

Smart grids	For the development of grid flexibility, which will be an integral feature of a RES-dominated system, it is necessary to implement new technologies that allow the efficient exchange of demand and supply information and the automation of some processes. Smart grids allow, among other things: • integration of all system components (of which there will be many more than in a system based on conventional generation sources), including PV installations, windmills, energy storage, electric cars, heat pumps • automatic adjustment of transmission and distribution • improving the quality and reliability of energy supply and reducing losses • reduced operating costs, e.g. through the possibility of remote reading	So far, investments in smart grids have mainly been made under the EU-funded **Infrastructure and Environment Operational Programme**. As a result, 3.5 million users in Poland have been connected to smart grids and 507 substations have been built/upgraded. In 2021, support for smart grid development will continue under the **European Funds for Infrastructure, Climate, Environment (FEnIKS) Programme** 2021-2027. Subsidising smart meters (described in Table 2) is a key element of smart grid development.	While investments have been made in smart grid development over the past few years, the pace of these efforts should accelerate to cover the entire population as soon as possible. This will require **financial support for innovation and pilot projects for smart grid development.** Also key to the development of smart grids will be the consistent deployment of smart meters according to the recommendations outlined above in Table 2.

6. Summary and general recommendations

While the legal framework and support for the development of low-carbon electricity has grown in recent years and some key regulations and solutions have been introduced, the scale of support remains far from sufficient, confirming little progress in decarbonising both the energy sector and the economy as a whole. The Polish transition continues to be hampered by key barriers at the political, administrative and technical levels.

Poland is at the tail end of the European Union when it comes to the targets set by climate and energy policy. One of the central elements of this policy is the development of RES. Poland's RES target for 2020 has been met largely on the back of a wave of new prosumer installations, which have come about due to the exceptionally favourable billing conditions and support from the 'My Electricity' programme.

In the report 'New paradigm'[27], we argued that the insufficient rate of growth of these installations is influenced by the oligopoly of state-owned companies that did not participate in decarbonisation (also due to the lack of market signals), and the lack of legislation to facilitate competition in the RES market. The most important blockages to the development of renewables include the 10H rule, introduced in 2016, inhibiting the development of onshore wind power, as well as the blockages to the development of the market for investments arising in cPPAs.

With the development of RES, which will become the backbone of the electricity system in a few to several years, Poland needs to prepare it for their integration. Systemic measures will be needed to support both the emergence of new controllable sources, increasing the flexibility of the grid and assisting in decentralisation. Key changes are still needed to support the development of energy communities, greater integration of demand-side activities (e.g. DSR) and energy storage.

Another key area of transformation is investment. Particularly neglected is the failure to allocate the already increasing revenues to the budget from the sale of greenhouse gas emission allowances (e.g. through the creation of the government's proposed Energy Transformation Fund) for several years, as well as the lack of agreement on the NIP[28]. In our first report on green strategic autonomy, we outlined possible sources of funding for these measures. It is important to bear in mind that most of the investment cost of decarbonising the economy will be borne by the private sector, and public funds should stimulate them (e.g. replacement of car fleets, investment in heat sources, energy efficiency etc.)[29].

27 M. Bukowski, K. Kobyłka, *New Paradigm. Why does the energy industry need competition?*, Warsaw 2022

28 We have written more extensively about the KPO in the reports *Halfway* and *Chasing Time*.

29 Auction revenues from the EU ETS can and should become one of the main sources of funding for decarbonisation measures - we wrote more about this in our first report on Green Strategic Autonomy.

In the case of the electricity sector, the needs for investment in renewables can be covered by the private sector, but support will be needed in several areas: key from the point of view of energy security and strategic investments, expansion of the grid and its digitalisation, stimulation of civic energy, energy storage.

At the same time, the role of the state will be to focus on an equitable redistributive approach. Climate change, environmental degradation and the energy transition itself disproportionately affect the lowest income households more. Poorer people are more exposed to the negative health effects of air pollution, rising energy prices or tightening environmental requirements for homes and personal transport. In addition, regions and municipalities heavily dependent on the extractive sector or linked to conventional power plants will be disproportionately more affected. The transition should therefore be accompanied by measures that are inclusive (e.g. through incentives to include low-income households in energy communities) and that protect vulnerable groups. Such measures are already taking place (e.g. the income criteria in the Clean Air Programme, the Stop Smog programme for those affected by fuel poverty). However, it should be borne in mind that the government has also used ineffective ad hoc measures, intended in theory to protect against the effects of the energy crisis, which have been widely criticised by experts, mainly for the lack of an income criterion[30]. A sound analysis of the redistributive impact of the policies pursued and of the measures to minimise the negative impact of the transition is needed to properly design these measures, which is lacking at the moment[31].

Poland also lacks a clear political signal for a green transition. This situation can be improved by an ambitious strategy, the implementation of which will be held accountable by those in power. The forthcoming update of key strategic documents such as the Energy Policy of Poland until 2040 and the National Energy and Climate Plan for 2021-2030 should therefore reflect an ambitious but feasible path for decarbonisation of the sector, with planned policies and measures to support and monitor the process. This will require a significant legislative and administrative effort, which is why the government's strong support for the transition would also strengthen the position of the Ministry of Climate and Environment, responsible for preparing most of the regulations in this area. This will translate into a predictable regulatory environment, which is essential for increasing the level of private investment, providing investors with a sense of security and stability.

30 One alternative based on an impact analysis was presented by the Polish Smog Alarm: https://polskialarmsmogowy.pl/wp-content/uploads/2022/07/Spoleczna-ustawa-o-dodatku-energetycznym.-Zalozenia-28-07-2022.pdf.

31 As one example, WiseEuropa has prepared an analysis of the impact of the EU ETS for buildings and road transport https://wise-europa.eu/wp-content/uploads/2022/05/Raport-krajowy-22.3.3.pdf.

WiseEuropa

The WiseEuropa Foundation

WiseEuropa is an independent think-tank specialising in macroeconomics, economic, European and foreign policy.

WiseEuropa's mission is to improve the quality of national and European policies and the economic environment by basing them on sound economic and institutional analyses, independent research and policy impact assessments. The Institute engages citizens, entrepreneurs, experts and public policy makers from home and abroad in a common reflection on the modernisation of Poland and Europe and their role in the world. WiseEuropa aims to work for an active and engaged role for Poland in the open, sustainable, democratic development of Europe. At the heart of WiseEuropa's activities is to stimulate and inspire public debate on the future of Poland and Europe.

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Energy and Climate Programme

Poland, Europe and the world are currently facing unprecedented challenges associated with the environment and resources. Avoiding dangerous climate change, improving public health and increasing resource security requires a profound economic transition. Taking advantage of opportunities and avoiding the associated developmental traps requires in-depth evaluation of the short- and long-term impacts of environmental protection and natural resource management policies. Under the Energy and Climate Programme, we prepare comprehensive sectoral and macroeconomic analyses, focusing on the broadly defined low-emission economic transition in Poland and globally. We are active in areas such as: Polish and EU energy and climate policy, domestic resource policy, improving resource efficiency in the economy, protection of the environment and public health by limiting harmful emissions, sustainable transport policy. This paper is a part of the Energy and Climate Project.

ENERGY AND CLIMATE

Other publications:

"Green turnaround. Regulatory changes to the EU trade policy"
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"Green Strategic Autonomy. Polish investment needs for independence from Russian imports of raw materials"
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