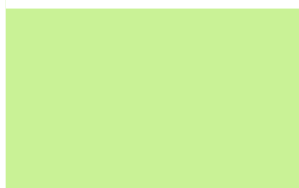


# ENERGY POLICY OF POLAND UNTIL 2040



**WARSAW  
2021**

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# 1. Introduction

## Climate and energy policy and the international context

Shaping the national energy strategy is strongly affected by the **European Union's (EU) climate and energy policy**, including its long-term vision of striving for EU climate neutrality by 2050 and the regulating mechanisms stimulating the achievement of effects in the coming decades. Meeting the EU's climate and energy objectives for 2020 and 2030 is key to a low-emission energy transition. Following the EU's decarbonisation ambition, in December 2020, the European Council approved a binding EU objective to reduce net greenhouse gas emissions by at least 55% by 2030, compared to 1990 emissions. This increased the previously binding 40% reduction target. The new EU's ambition is defined as a collective target for the whole Union, i.e. implemented on the basis of Member States' contributions, taking into account national considerations, specific starting points, reduction potential, the principle of sovereignty in shaping the national energy mix, the need to guarantee energy security; in the most cost-effective manner possible, to maintain affordable energy prices for households and the EU's competitiveness; as well as taking account of the principle of equity and solidarity. Following the EU's dynamically accelerating climate and energy trends will be a significant transition challenge for Poland.

The targets specified for 2020 are the reference point on the path of the long-term energy transition.

A package of regulations was adopted in 2009, setting three fundamental targets to counteract climate change by 2020 (the so-called 3 x 20% package), with Member States participating in accordance with their capabilities. Poland is obliged to:

- increase energy efficiency by saving 13.6 Mtoe of primary energy consumption over the 2010-2020 period compared to the fuel and energy demand forecast from 2007;
- increase the share of RES energy in gross final energy consumption to 15% by 2020;
- contribute to an EU-wide reduction of greenhouse gas emissions by 20% (compared to 1990) by 2020 (in terms of 2005 levels: -21% in EU ETS sectors and -10% in non-ETS sectors).

In 2014, the European Council maintained the direction of counteracting climate change and approved four targets for the 2030 perspective for the entire EU, which, after 2018 and 2020 revision, have the following shape:

- reduction of greenhouse gas (GHG) emissions by at least 55% compared to 1990 emissions;
- at least 32% share of renewable sources in the gross final energy consumption;
- increase in energy efficiency by 32.5%;
- completing the establishment of the EU's internal energy market.

These targets are the EU's contribution to the implementation of climate agreements. Key importance to current policy and action has the so-called **Paris Agreement**, concluded in December 2015 at the 21st Conference of the Parties to the *United Nations Framework Convention on Climate Change* (COP21). It indicates the need to stop the increase in global average temperature at less than 2°C in relation to the levels of pre-industrial era, and efforts should be made to keep it at no more than 1.5°C. During the 24th Conference (COP24), in December 2018, during the Polish Presidency, the so-called Katowice Climate Package implementing the Paris Agreement was signed. Particular attention was given to the fact that the *transition* resulting from the Paris Agreement must take place in a just and solidary manner.

In 2019, the EU's work over the *Clean Energy for All Europeans* regulation package was completed, the package indicating how to operationalise the EU's climate and energy

targets for 2030 and intended to contribute to the **implementation of the Energy Union** and the **establishment of a single EU energy market**. The Polish government took an active part in shaping the final wording of the regulations as they strongly affect the functioning and defining the future of the energy market model in Poland.

The outlook assumes further revision of the key EU regulations concerning the energy sector, which will refer to the targets and tools of the European Union's energy and climate policy in a time horizon that goes beyond 2030. This applies in particular to the decisions on the long-term vision for reducing greenhouse gas emissions in the EU by 2050. For this reason, the outlook after 2030 has been defined directionally, even though the forecasts made for PEP2040 have an outlook for 2040 as required by law.

In 2019, the European Commission published a communication on the **European Green Deal**, i.e. a strategy whose ambitious goal is for the EU to achieve climate neutrality by 2050 – as a global leader in this area. Poland supported this goal, but developed a specific national derogation due to the difficult starting point of the Polish transition and its social and economic aspects. Poland has made great progress in reducing the environmental impact of its energy sector over the past several years, in particular by modernising its generation capacity and diversifying its energy generation structure. However, our dependence on carbon fuels is still much higher than that of other EU Member States, and that is why a **just transition** is so important to us, which means taking into account the starting point, the social context of the transition, and counteracting the uneven distribution of costs between countries, more burdensome for economies with a high use of carbon fuels. It must be emphasised that the costs relate to both coal regions (mining and power) and entire economies, which in the short term incur expenditures on new capacity, often also on economically immature, more expensive technologies, power grid infrastructure, which is also reflected in the price of energy.

**A coronavirus pandemic** hit the world in 2020, affecting all global economies. This emergency situation has also revealed the important role of the energy sector, including energy security, for the functioning of the economy of Poland and other European countries. In the coming years, the energy sector will face a number of post-COVID challenges related to, among others, rebuilding or substituting supply chains in order to conduct investments, mobilising financial resources in budgets strained by the effects of the epidemic, and sometimes – revising investment plans and accumulating resources for key undertakings. It is important that investment decisions are made taking into account the aspect of green and low-emission economic recovery. Recovery actions after the pandemic are aimed to **provide a quick and effective growth boost** and create new opportunities for the national economy. In addition to the protective tools and measures mobilising domestic public resources, also EU support will be used.

The energy transition will require the involvement of many entities and incurring considerable investment outlays<sup>1</sup>, the scale of which in the years 2021-2040 may reach approx. PLN 1,600 billion. Investments in the fuel and energy sectors will involve financial resources of approx. PLN 867-890 billion. The estimated outlays in the electricity generation sector will amount to approx. PLN 320-342 billion, of which approx. 80% will be allocated to zero-emissions units, i.e. RES and nuclear power. As a result of the above mentioned deep transition of the fuel and energy sector, energy costs may increase. A number of investments can receive financial support (operational and investment), resulting in changes happening as quickly as possible and on a larger scale. It is important that the manner in which the transition is carried out ensures socially acceptable energy prices and does not deepen energy poverty.

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<sup>1</sup> See Chapter 6 and Appendix 2 to PEP2040 for more information.

Around PLN 260 billion from the EU and national funds under various mechanisms will be allocated to the national energy and climate transition until 2030<sup>2</sup>, including:

- a. *Cohesion Policy* (approx. PLN 79 billion<sup>3</sup>),
- b. *Recovery and Resilience Facility* (approx. PLN 97.8 billion<sup>4</sup>),
- c. *Just Transition Fund* (allocation for Poland of approx. PLN 15.6 billion),
- d. *React-EU* (approx. PLN 1.8 billion<sup>5</sup>),
- e. Other facilities (e.g. priority programmes of the National Fund for Environmental Protection and Water Management and funds of the Common Agricultural Policy of approx. PLN 20 billion).
- f. New instruments which will support the energy system transition in Poland, e.g. the Modernisation Fund and the national earmarked fund funded from the sale of CO<sub>2</sub> emission allowances, i.e. the Energy Transition Fund (for which preliminary estimates indicate over PLN 47.6 billion<sup>6</sup>).

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<sup>2</sup> Based on estimates of the Ministry of Climate and Environment.

<sup>3</sup> The total allocation for Poland is approx. EUR 66.8 billion. Under the Cohesion Policy, 30% of the European Regional Development Fund and 37% of the Cohesion Fund should be allocated to climate action, i.e. approx. EUR 17.7 billion.

<sup>4</sup> In current prices, the allocation for Poland under this mechanism is approx. EUR 24.9 billion in non-repayable grants and EUR 34.2 billion in loans, which in total amounts to approx. EUR 59.1 billion. 37% of this should be used for climate targets, i.e. approx. EUR 21.9 billion.

<sup>5</sup> Currently, there are currently no final rulings on ReactEU. It is estimated that for Poland the allocation may amount to approx. EUR 2 billion. It is assumed that about 20% of these funds will be allocated for the energy sector, which gives approx. EUR 0.4 billion.

<sup>6</sup> Based on estimates of the Ministry of Climate and Environment.

## Abstract

**Energy Policy of Poland until 2040** (PEP2040) sets the framework for the energy transition in Poland. It contains strategic decision regarding the selection of technologies used to establish a low-emission energy system. PEP2040 contributes to the implementation of the *Paris Agreement* concluded in December 2015 at the 21st Conference of the Parties to the *United Nations Framework Convention on Climate Change* (COP21), taking into account the need to achieve the transition in a just and solidary manner. PEP2040 is a national contribution to the EU's climate and energy policy, whose ambition and dynamism have increased significantly in recent times. The policy takes into account the scale of the challenge of adapting the domestic economy to EU regulatory considerations related to the 2030 climate and energy targets, the European Green Deal, the COVID pandemic recovery plan and the pursuit of climate neutrality in line with national capabilities as a contribution to the Paris Agreement. The low-emission energy transition envisaged in PEP2040 will initiate broader modernisation changes across the economy, guaranteeing energy security, ensuring fair distribution of costs and protecting the most vulnerable social groups.

PEP2040 is one of nine integrated sectoral strategies resulting from the *Strategy for Responsible Development*. PEP2040 is consistent with the *National Energy and Climate Plan 2021-2030*

PEP2040 includes **a description of the status and conditions** of the energy sector. Then, the **three PEP2040 pillars** were identified, on which the **eight PEP2040 specific objectives** were based, along with the **measures** necessary for their implementation, as well as **strategic projects**. A territorial approach was presented and the sources of PEP2040 funding were indicated.

pillars	Pillar I. Just transition		
	Pillar II. Zero-emission energy system		
	Pillar III. Good air quality		
SPECIFIC OBJECTIVE 1. <b>Optimal use of own energy resources</b>	SPECIFIC OBJECTIVE 2. <b>Expansion of electricity generation and grid infrastructure</b>	SPECIFIC OBJECTIVE 3. <b>Diversification of supply and development of network infrastructure for natural gas, crude oil and liquid fuels</b>	
STRATEGIC PROJECT 1. <b>Transition of coal regions</b>	STRATEGIC PROJECT 2A. <b>Capacity market,</b> STRATEGIC PROJECT 2B. <b>Implementation of smart grids</b>	STRATEGIC PROJECT 3A. <b>Construction of the Baltic Pipe</b> STRATEGIC PROJECT 3B. <b>Construction of Line 2 of the Pomeranian Pipeline</b>	
SPECIFIC OBJECTIVE 4. <b>Development of energy markets</b>		SPECIFIC OBJECTIVE 5. <b>Implementation of nuclear power</b>	SPECIFIC OBJECTIVE 6. <b>Development of renewable energy sources</b>
STRATEGIC PROJECT 4A. <b>Implementation of the Action Plan</b> (to increase cross-border electricity transmission capacity) STRATEGIC PROJECT 4B. <b>Gas hub,</b>		STRATEGIC PROJECT 5. <b>Polish Nuclear Power Programme</b>	STRATEGIC PROJECT 6. <b>Implementation of offshore wind energy</b>

STRATEGIC PROJECT 4C. <b>Development of electromobility</b>		
<b>SPECIFIC OBJECTIVE 7. Development of district heating and cogeneration</b>	<b>SPECIFIC OBJECTIVE 8. Improvement of energy efficiency</b>	
STRATEGIC PROJECT 7. <b>Development of district heating</b>	STRATEGIC PROJECT 8. <b>Promoting energy efficiency improvement</b>	

The statutory **objective of the state energy policy** is energy security<sup>7</sup>, while ensuring the competitiveness of the economy, energy efficiency and the reduction of the environmental impact of the energy sector.

PEP2040 **specific objectives** cover the entire energy supply chain - from the acquisition of raw materials, through energy generation and supply (transmission and distribution), to the way it is used and sold. Each of the eight specific objectives of PEP2040 contributes to the implementation of the three elements of the state energy policy objective and serves Poland's energy transition.

The document is accompanied by (1) an evaluation of the implementation of the previous state energy policy, (2) conclusions from the forecast analyses and (3) the Strategic Environmental Assessment of PEP2040.

## The three pillars of energy transition

Through the implementation of the objectives and actions indicated in PEP2040, a low-emission energy transition will be carried out with the active role of end consumers and the involvement of domestic industry, giving a stimulus to the economy, while ensuring energy security, in an innovative and socially acceptable manner, respecting the environment and the climate.

The **energy transition** to be carried out in Poland will be:

- just** - it will not leave anyone behind,
- participatory**, conducted **locally**, initiated **bottom-up** - everyone will be able to participate in it,
- focused on modernisation and **innovation** - it is a plan for the future,
- stimulating **economic growth**, **efficiency** and **competitiveness** - it will be the **engine of economic growth**.

## The energy transition will be based on three pillars:

- just transition** - means providing new development opportunities for the regions and communities most negatively affected by the low-emission energy transition, while creating new jobs and building new branches of industry that participate in the energy sector transition. Activities related to the transition of coal regions will be supported with funds amounting to

<b>Pillar I. Just transition</b>	<b>Pillar II. Zero-emission energy system</b>	<b>Pillar III. Good air quality</b>
Transition of coal regions		
Reducing energy poverty	Offshore wind energy	Transition of district heating
New branches of industry related to RES and nuclear power	Nuclear energy	Electrification of transport
	Local and civic power generation	"Dom z Klimatem" Programme

<sup>7</sup> According to the *Energy Law*, energy security means the state to satisfy the current and future demand for fuel and energy in a manner, while maintaining the requirements of environmental

approx. PLN 60 billion. In addition to the regional approach, the transition will involve individual energy consumers, who on the one hand will be shielded from the increase in energy prices and on the other hand will be encouraged to actively participate in the energy market. This will ensure that the energy transition is conducted justly and that everyone - even small households - can participate. The transition will use national competitive advantages, create new development opportunities and initiate broad modernisation changes, allowing to create up to 300 thousand new jobs in high-potential industries, in particular related to RES, nuclear power, electromobility, grid infrastructure, digitalisation, thermal modernisation of buildings, etc.

- II. **zero-emission energy system** - it is a long-term direction in which the energy transition is heading. Decarbonisation of the energy sector will be possible through the implementation of nuclear power and offshore wind energy, increasing the role of distributed and civic power generation, but also through the involvement of industrial energy, while ensuring energy security through transitional use of energy technologies based, among others, on gaseous fuels;
- III. **good air quality** - this goal is one of the most noticeable signs of moving away from fossil fuels; thanks to investments in the district heating sector transition (system and individual), electrification of transport and promotion of passive and zero-emission houses using local energy sources, air quality will visibly improve, which has an impact on the environmental health; the key result of the transition, which will be noticed by every citizen, will be ensuring clean air in Poland.

## Key elements of PEP2040

<p><b>Energy transition</b> including power self-sufficiency</p>	<p><b>Offshore wind energy</b> the installed capacity will reach: approx. 5.9 GW in 2030 up to approx. 11 GW in 2040</p>	<p>There will be a significant increase of installed capacity in <b>photovoltaics</b> of approx. 5-7 GW in 2030 and approx. 10-16 GW in 2040</p>	
<p><b>Increase of the share of RES</b> in all sectors and technologies. In 2030, the share of RES in gross final energy consumption <b>will be at least 23%</b></p> <ul style="list-style-type: none"> <li>– not less than 32% in power industry (mainly wind energy and PV)</li> <li>– 28% in heating sector (increase by 1.1 pp y/y)</li> <li>– 14% in transport (with a strong contribution from electromobility)</li> </ul>	<p>In 2030, <b>the share of coal in electricity generation</b> will not exceed 56%</p>	<p>The reduction of the use of coal in the economy will be conducted in a way ensuring a <b>just transition</b></p>	
<p><b>Energy efficiency</b> will increase - a target of 23% reduction in primary energy consumption in relation to PRIMES2007 forecasts has been set for 2030</p>	<p>Investment programs of the TSOe and DSOe will be targeted at the development of RES and <b>active consumers</b> and local balancing</p>	<p>The first <b>nuclear power plant</b> power unit with a capacity of about 1-1.6 GW will be commissioned in 2033. Further power units will be commissioned every 2-3 years, and the entire nuclear program assumes the construction of 6 power units.</p>	
<p>By 2040, the <b>heating needs of all households</b> will be covered by district heating and by zero- or low-emission individual sources</p>	<p><b>Natural gas</b> will be a bridge fuel in the energy transition</p>	<p>In 2030, the ability to transport a gas mixture containing about <b>10% of decarbonised gases</b> through the gas networks will be achieved</p>	<p>The natural gas, crude oil and liquid fuels infrastructure will be expanded and also the diversification of supply directions will be ensured</p>
<p>A number of actions will be aimed at <b>improving air quality</b>, such as:</p> <ul style="list-style-type: none"> <li>– development of district heating (4-fold increase in the number of efficient district heating systems by 2030)</li> <li>– low-emission direction of the transition of individual sources (heat pumps, electric heating) <ul style="list-style-type: none"> <li>– <b>abandonment of coal use in households</b> in cities by 2030, in rural areas by 2040; while maintaining the possibility of using smokeless fuel by 2040</li> <li>– increasing the energy efficiency of buildings</li> </ul> </li> <li>– development of low-emission transport, in particular <b>aiming at zero-emission public transport</b> in cities over 100 thousand inhabitants <b>by 2030</b></li> </ul>		<p><b>Reduction of the phenomenon of energy poverty</b> to the max. of 6% of households</p>	
<p>By 2030, there will be a reduction in <b>GHG emissions of about 30%</b> compared to 1990.</p>		<p>The most anticipated <b>development in energy technology</b> and R&amp;D investments includes:</p> <ul style="list-style-type: none"> <li>– energy storage technologies</li> <li>– smart metering and energy management systems</li> <li>– electromobility and alternative fuels <ul style="list-style-type: none"> <li>– hydrogen technologies</li> </ul> </li> </ul>	



## Specific objectives of PEP2040

### Specific Objective 1. Optimal use of own energy resources

STRATEGIC PROJECT 1.  
Transition of coal  
regions

Domestic raw material potential creates the possibility to cover the demand for coal and biomass independently, however, the majority of demand for natural gas or crude oil has to be covered by import. Due to finite resources, economic and ecological aspects, the protection of documented mineral deposits as well as rational and economical management of raw materials are of key importance.

The demand for **hard coal** will be covered by own resources and the import-export relation will be complementary. The role of this raw material will be limited. During the evolutionary transition of the Polish energy sector, it is necessary for the Polish mining sector to ensure reliable hard coal supplies at competitive prices. This is why it is necessary to ensure profitability of the sector and rational mining, use and distribution of the raw material.

The demand for **lignite** will be covered by domestic resources, close to the place of its use. Prospective deposits (Złoczew and Ościslówo) will be secured due to their strategic nature, however, their extraction will depend on the decisions of investors. The prices of CO<sub>2</sub> emission allowances, environmental conditions and development of new technologies will play a key role in their management.

Research and development activities should be aimed at searching for innovations to reduce the environmental burden resulting from coal mining and new solutions that contribute to low-emission, efficient and flexible use of the raw material (e.g. gasification, liquid fuels).

For social, economic and environmental reasons, coal regions will be restructured so as to ensure that a **just energy transition** leads to economic reinforcement, leaves no one behind and will serve future generations. This process will be supported by financial instruments under the EU's Just Transition Mechanism, mobilising **support resources of PLN 60 billion**. Detailed solutions in this regard will be included primarily in national and territorial plans for a just transition.

The demand for **natural gas and crude oil** will be covered mainly with imported raw materials. Actions will be implemented, aimed at diversification of supply directions and sources. At the same time, search for domestic deposits (also unconventional) will be continued, to replace supply from depleted deposits. Part of the demand for crude oil and natural gas will be diminished by the growing importance of biofuels and alternative fuels (e.g. electricity, LNG, CNG, biomethane, hydrogen).

The demand for **renewable raw materials (biomass)** will be covered as close as possible to the place of generation. Efforts will be made to increase the role of waste biomass in order not to compete with other sectors. The potential accumulated in non-agricultural waste and wastewater should also be used.

### Specific Objective 2. Expansion of electricity generation and grid infrastructure

STRATEGIC PROJECT 2A.  
Capacity market,  
STRATEGIC PROJECT 2B.  
Implementation of  
smart grids

The power balance must ensure stability of energy supply and flexibility of operation of the power system, as well as the fulfilment of international obligations and respond to changes in the energy market and global trends. At the same time, only an efficient and sufficiently developed infrastructure will ensure security of energy supply. The development of generation and grid infrastructure will lead to the creation of an almost new power system by 2040, based largely on zero-emission sources.

Poland will strive **to be able to cover its power demand with its own resources**. Domestic coal resources will remain an important element of Poland's energy security, but an increase in demand will be covered by sources other than conventional coal-fired units.

The share of coal in the energy consumption structure will reach less than 56% in 2030, and with increased prices of CO<sub>2</sub> emission allowances it may even fall to the level of 37.5%. **Renewable sources** will play an increasingly important role – their level in the structure of net national electricity consumption will reach no less than 32% in 2030, which will primarily enable the development of photovoltaics and offshore wind farms, which due to economic and technical conditions have the greatest prospects for development. In order to achieve such a level of RES in the balance, it is necessary to develop **grid infrastructure, energy storage technologies**, as well as to expand the use of **gas units** as regulating capacity. In 2033, **nuclear power** will be implemented (a total of 6 nuclear power units with a total capacity of 6-9 GW will be built), which will strengthen the base of the system and reduce emissions from the sector. Also in order to **reduce pollutant emissions** from the energy sector, low-efficiency generation units will be gradually phased out and replaced with higher-efficiency units (including cogeneration units). With a view **to 2040, an almost new power system will be built** with a strong base of low- and zero-emission

sources.

**The development of the transmission infrastructure** will allow to connect the existing and new sources (including wind and nuclear power) to the grid and to improve power supply security, as well as to increase cross-border exchange opportunities, while preserving the principle of self-sufficiency of generation capacity in Poland. Investments in **distribution systems** (grid reconstruction, medium-voltage network cabling) will improve the quality of supply to end consumers, which means in particular shortening the duration of energy supply interruptions. Furthermore, investments will contribute to the gradual transition of the passive (one-way) network into an active (two-way) network. To improve the efficiency of operation in emergency situations, a digital communication system between distribution system operators will be implemented and the infrastructure will be equipped with control devices. In addition, **smart grids** will be implemented to integrate the behaviour and actions of all entities and users connected to them.

Specific Objective 3.  
**Diversification of natural gas and oil supplies and development of grid infrastructure**

STRATEGIC PROJECT 3A.  
**Construction of the Baltic Pipe**

STRATEGIC PROJECT 3B.  
**Construction of Line 2 of the Pomeranian Pipeline**

Poland's strong dependence on **natural gas** supply from just one direction requires diversification in this regard. To this end, the Baltic Pipe (Norway-Denmark-Poland connection) will be constructed, the LNG terminal in Świnoujście will be expanded and an FSRU floating terminal in the Gulf of Gdańsk will be built. Connections to neighbouring countries will also be extended. In order to enable further development of the gas market, the natural gas import potential will be used and the so-called "white spots" will be eliminated. The national transmission and distribution network (also with the use of local LNG and biogas regasification stations) as well as the storage infrastructure, will be expanded. This is important because natural gas is a bridge fuel of the transition.

To an even greater extent, Poland is dependent on **crude oil** supplies, therefore it is necessary to ensure conditions for the reception of crude oil and smoothly functioning internal infrastructure. The possibility of supplies by sea will be increased, which will be facilitated by the expansion of the Pomeranian Oil Pipeline, as well as the storage depots for crude oil and liquid fuels. The supply of petroleum products depends on an adequately developed pipeline network, especially in the southern part of Poland, which will also undergo expansion, e.g. the Boronów-Trzebinia pipeline.

Specific Objective 4.  
**Development of energy markets**

STRATEGIC PROJECT 4A.  
**Implementation of the Action Plan** (to increase cross-border electricity transmission capacity)

STRATEGIC PROJECT 4B.  
**Gas hub,**

STRATEGIC PROJECT 4C.  
**Development of electromobility**

**The electricity market** is subject to further liberalisation. Active participation of consumers in the energy market and strengthening their position in the market is promoted. This means broadening the information policy, enabling consumers

to actively participate in the energy market by e.g. participating in DSR and bringing order to general distribution agreements. In order to protect the competitiveness of Polish energy-intensive enterprises, mechanisms reducing the cost burden of support schemes will also be addressed to this group. In order to ensure better conditions for the operation of the transmission and distribution grids, selected services will be developed and acquired, including DSR and ancillary services. Also the possibility of creating local balancing areas will be provided. The cross-border transmission capacity will be gradually increased thanks to the implementation of the Action Plan, which is part of the systematic development of the electricity transmission grid in Poland.

The **natural gas market** will undergo further liberalisation, which will be achieved, among others, by releasing trading companies from the tariff obligation for the last group of consumers, i.e. households. It is also important to strengthen Poland's position in the European gas market, which will be facilitated primarily by the creation of a regional gas transmission and trading centre (hub). To this end, it is necessary to further develop the service and commercial offer. The market will also develop due to the progressing gasification of the country and the increase in the use of gas in segments which have so far accounted for a small part of overall consumption, e.g. households, industry, district heating, power generation, including units which can act as back-up for unstable RES, and transport.

The **petroleum products market** is relatively stable, although it will undergo transition in the coming years. It is necessary to organise the ownership structure of fuel market segments, so that refinery companies focus on fuel production and trade, and the state has control over infrastructure of key importance to fuel security. The market needs to respond to the increase in the use of petrochemicals in the economy (from 3D printers to construction industry), but also take action to decarbonise traditional fuels. At the same time, part of the demand for petroleum products will be covered by greater use of **bio-components and alternative fuels** (LNG, CNG, biomethane, hydrogen, synthetic fuels) and **development of electromobility**.

The **hydrogen market** will be subject to development, supported by successive regulatory work and adjustment of support schemes for investment, research and development activities and the construction of domestic technological facilities. It is necessary to use the favourable conditions for the development and financing of hydrogen technologies created under EU policies (European Green Deal, European gas market reform). In the long-term outlook, the growth of hydrogen technologies with simultaneous development of the value chain of the hydrogen economy will support the increase of the share of renewable energy sources (owner-to-x energy storage technology), will give a new role to the gas sector in terms of storage, transmission and distribution of natural gas and hydrogen mixtures, and will be a tool for the decarbonisation of transport and industry. National law regulating the development of the hydrogen market will be created in parallel to the planned European regulations.

Specific Objective 5.  
**Implementation of nuclear power**

STRATEGIC PROJECT 5.  
**Polish Nuclear Power Programme**

In 2033, the **first nuclear power unit** with a capacity of 1-1.6 GW will be commissioned, with subsequent units to be launched every 2-3 years - the entire nuclear power programme assumes the construction of 6 units by 2043. Nuclear power plants ensure **stable power generation with zero air pollutant emissions**. At the same time, it is possible to **diversify the energy generation structure at a reasonable cost**. The technologies currently in use (of 3rd and 3rd+ generation) and

stringent worldwide nuclear safety standards ensure high **safety standard for nuclear power plant operation** and waste storage. A considerable part of the nuclear programme can be implemented with the participation of Polish enterprises.

The implementation of nuclear power requires earlier legal changes, facilitating the implementation of the programme, as well as completion of work on the financing model. After research, the final location of the first and further nuclear power plant power units will be selected and a new low- and intermediate-level radioactive waste repository will be commissioned. Also the technology and the general contractor for the construction will

be selected. Action will also be taken to provide **adequate human resources**, both for the construction of the plant and its proper operation, and for nuclear supervision.

There is also the potential to use high-temperature reactors (HTRs), which, not being an alternative to large-scale light-water nuclear power units, could be used in the future mainly as a source of process heat for industry.

Specific Objective 6.  
**Development of  
renewable energy  
sources**

STRATEGIC PROJECT 6.  
**Implementation of  
offshore wind energy**

The increasing role of renewable energy sources is driven by the need for a low-emission energy transition through diversification of the energy balance and the reduction of its carbon intensity, as well as contribution to the EU-wide target of 32% RES in gross final energy consumption, as well as by the decreasing costs of such energy generation technologies. Poland declares reaching at least **23% share of RES in gross final energy consumption in 2030** (*in power generation sector - at least 32% net, in heating and cooling sector - increase of 1.1 pp y/y, in transport - 14%*). Having in mind the expected technological development, a special role in achieving the RES target will be played by **offshore wind farms, whose development is a strategic decision on the growth of key competence in this field in Poland, enabling economic development**. Further development of **photovoltaics** is expected, the operation of which is correlated with summer electricity demand peaks, as well as of onshore wind farms, which generate electricity in a time frame similar to the offshore wind farms. Also the importance of **biomass, biogas and geothermal energy** in district heating and **heat pumps** is expected to increase in individual heating, while transport needs to increase the use of **advanced biofuels and electricity**.

Distributed energy generation based on energy production from RES, sales, storage or participation in DSR programmes by individual entities (e.g. active consumers, renewable energy prosumers and others) and energy communities (e.g. energy clusters, energy cooperatives) will also develop. It is expected that by 2030 the number of prosumers will increase approx. 5-fold and that the number of energetically balanced areas at local level will grow to 300. To secure the future operation of the NPS, the connection of an unstable energy source will involve the **obligation to ensure balancing** in periods when the RES does not supply electricity to the grid. **RES support mechanisms** will give priority to solutions ensuring maximum availability, with the relatively lowest cost of energy production and covering local energy demand, as well as hybrid solutions combining various RES technologies, self-balancing e.g. with the use of energy storage.

Specific Objective 7.  
**Development of district heating and cogeneration**

STRATEGIC PROJECT 7.  
**Development of district heating**

Covering heat demand is done at the local level, therefore it is extremely important to ensure **energy planning at the level of communes** and regions – this is of key importance for rational energy management, improving air quality and using local potential. Also launching a nationwide heat map<sup>8</sup> will be a useful tool, facilitating the planning of covering heat demand. A key target has been indicated for 2040, to meet heating demand for all households in a zero- or low-emission manner.

In the areas where technical conditions for the supply of heat from an energy-efficient district heating system exist, **the consumers should use heat from district heating first**, unless they use a more green solution. It is necessary to enforce this obligation consistently. **Approximately 1.5 million new households** will be connected to the district heating network by 2030. At the same time, a new market model will be developed so that heat prices are acceptable to consumers and at the same time enable covering justified costs together with a return on the capital invested. Concurrently, there is a **2030 target of meeting the criteria of an energy-efficient district heating system by at least 85% of heating or cooling systems** with a contracted capacity exceeding 5 MW. The development of **high-efficiency cogeneration, converting power plants to CHP plants, increasing the use of RES and waste in district heating**, upgrading and expanding heat and cold distribution systems and popularising heat storage and smart grids will contribute to meeting the target.

**Individual heating demand** should be covered by sources with the lowest possible carbon intensity (heat pumps, electric heating, natural gas, smokeless fuels) while the use of **coal** should be **abandoned - by 2030 in cities and by 2040 in rural areas**. The monitoring of emissions at single-family houses and bringing consequences against those responsible for pollution will increase.

Specific Objective 8.  
**Improvement of energy efficiency**

STRATEGIC PROJECT 8.  
**Promoting energy efficiency improvement**

Poland sets a **national target to improve energy efficiency of primary energy consumption by 23% by 2030, as compared to 2020** according to PRIMES 2007 forecast. The potential for improving energy efficiency lies in almost the entire economy. It involves also the implementation of new technologies and increasing the innovativeness of the economy, affecting its attractiveness and competitiveness. Pro-efficiency action leads to a reduction in energy consumption and energy costs, although the benefits often have to be considered in a

perspective reaching outside the return period of such investments.

The increase in the energy efficiency of the economy will be created by obliging a group of entities to improve energy efficiency or to purchase energy efficiency certificates, as well as by using legal and financial incentives for pro-efficiency action. Essential is also the exemplary role of the public sector, resulting in investments that will be characterized by innovation and higher standards and norms of energy efficiency, as well as the improvement of the awareness of rational energy consumption with the full involvement of the society (local communities, business operators) aimed at energy-efficient equipment, products and technologies .

<sup>8</sup> Prepared in connection with Art. 14 of the revised Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency.

Inefficient use of energy is strongly linked to the problem of **low-stack emissions** (burning low quality coal and garbage in households; improper use of the heating system; burning coal in local low efficiency heating plants; traffic pollution). The main tool for dealing with the problem is a nationwide **thermal modernisation of residential buildings and ensuring efficient and environmentally friendly access to heat**, which will also positively affect reducing the problem of **energy poverty by 30%, i.e. to the level of up to 6% of households in 2030**. The reduction of traffic emissions will be supported by the development of electromobility and hydrogen-mobility, and a number of actions planned to develop the alternative fuels market. In the area of **public transport**, pursuing deep reduction of GHG emissions is foreseen, and **in cities over 100 thousand inhabitants - achieving zero-emission of public transport from 2030 onwards**.

## Position in the legal system and in the national development management system

The ***Energy Policy of Poland until 2040*** is an answer to the most important challenges that Poland has to face to cover the energy demand in the coming decades and sets out the directions for the development of the energy sector, taking account of the tasks needed to be implemented in the short- and medium-term perspective.

The *Energy Policy of Poland until 2040* is one of the nine strategies resulting from the document titled National Development Management System, for which the medium-term country development strategy is the basis, i.e. the one adopted on 14 February 2017 ***Strategy for Responsible Development*** (SOR). Its main objective is to create conditions for the growth of income of Polish inhabitants, while ensuring the growth of cohesion in the social, economic, environmental and territorial dimensions. *Energy* is one of the areas that affect the achievement of this objective and the specific objectives of SOR.

Among the other strategies resulting from SOR, PEP2040 is the one most strongly linked to the *National Environmental Policy 2030*<sup>9</sup> and the *Strategy for Sustainable Transport Development 2030* with respect to reducing CO<sub>2</sub> and pollutant emissions and the so-called low-stack emissions, the *Strategy for Sustainable Development of Rural Areas, Agriculture and Fisheries 2030* with respect to utilising the potential of agriculture and rural areas for energy purposes, the *Productivity Strategy* and the *National Regional Development Strategy 2030* in the context of mutual relations between the energy sector and the productivity of the economy and the development of the country.

PEP2040 is more directly linked to the *Human Capital Development Strategy*, the *Social Capital Development Strategy* and the *"Efficient and Modern State" Strategy*, which form the background for PEP2040. Human capital influences the quantity and quality of knowledge, skills and potential contained in society, which have an impact on the opportunities to develop the energy sector. The condition of social capital affects relations in society and social responsibility, which in turn condition the manner of implementation of PEP2040. It should be also emphasised that PEP2040 reaches beyond the time frame of SOR. Changes in the energy sector take place over many years and the effects are visible in a long-term perspective, which is reflected in energy forecasts. PEP2040 is also strongly connected with the *National Raw Materials Policy* under creation, which is aimed at ensuring the country's raw material security through the continuous expansion of the raw material resource base, including energy sources, and the intensification of activities in the area of exploration, investigation and management (mining) of geothermal water deposits and heat of dry rocks.

The state energy policy is developed by the minister responsible for energy on the basis of Art. 12, 13-15 of the *Energy Law* and in accordance with the *Act on the principles of development policy*, while its implementation is the responsibility of a number of entities, in particular the Minister of Energy and Climate and the Council of Ministers.

In 2019, Poland has developed the *National Energy and Climate Plan 2021-2030* (KPEiK)<sup>10</sup>, consistent with the *Energy Policy of Poland until 2040*. The scope and layout of KPEiK correspond to the challenge of establishing the Energy Union, while PEP2040 addresses also other national needs. With the adoption of PEP2040, the *Energy Policy of Poland until*

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<sup>9</sup> Abbreviated names of legal acts and strategic documents are used in the text; full names are indicated in Chapter 9.

<sup>10</sup> The development of KPEiK stems from the Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union.

*2030* of 2009 and the *Strategy for Energy Security and Environment - Perspective until 2020* of 2014 are repealed.<sup>11</sup>

The draft PEP2040 was subjected to a preliminary public consultation in 2018, followed by a public consultation procedure in 2019 under the Strategic Environmental Assessment. An evaluation study was also carried out by an external entity as part of ex-ante evaluation of the drafts of 9 development strategies resulting from SOR. Conclusions from both stages were used to introduce corrections and additions to the content of PEP2040, including measures planned in the document.

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<sup>11</sup> Part of the ESE Strategy was repealed with the adoption of the *National Ecological Policy 2030 - development strategy in the area of environment and water management* - i.e. in parts concerning Objective 1. Sustainable management of environmental resources (excluding Measure 2. Aiming to maintain coal mining at a level which ensures that domestic demand is met) and Objective 3. Improvement of the environment.

## Structure of the document

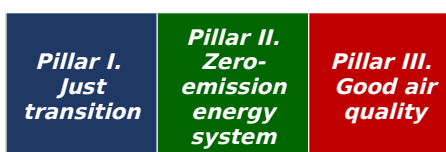
The structure of the document includes **an abstract**, the **purpose of the energy policy** (Chapters 1-2), the eight **strategic objectives** of PEP2040 together with diagnoses, areas of intervention and the necessary **strategic measures** and **projects**.

The planning horizon of PEP2040 covers 20 years. Executive measures within operational planning have been programmed for a perspective of several or more years. The effects of implementing the directions and measures are reflected in the forecast part with a horizon until 2040, which is attached hereto.

Each of PEP2040's specific objectives and all the strategic actions and projects contained therein have been embedded in the three elements of PEP2040's objective - energy security, competitiveness and improvement of the energy efficiency of the economy as well as the reduction of the environmental impact (the symbols used are indicated on the side).



The implementation of PEP2040, based on the three pillars described below, will lead to the **energy transition** of Poland in a **just and participatory** manner (conducted locally and with the active role of end consumers). PEP2040 is focused on the **modernisation of the energy sector, aiming at zero-emission development** and stimulating innovation, leading to constant economic growth, improved efficiency and competitiveness. The implementation of PEP2040 will **improve air quality**, respect for the environment and climate protection.

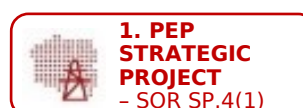


*In order to provide clarity for the reader, each detailed objective is distinguished by a different colour, used also to mark the **intervention areas**. The diagram also indicates which **pillar of transition** corresponds most strongly to the given intervention.*



*The description of an intervention area includes a specification of **measures**, collected in tables summarising the given subchapter, with an indication of the dates of their implementation and the entities responsible (the first indicated entity is the leading one).*

*Each specific objective indicates a strategic project that is particularly relevant to the development challenges. In the case of Specific Objectives 2-4, a project has been defined for each part. PEP2040 identifies 12 strategic projects. They constitute an extension of the list of SOR projects in the "Energy" area (the full list can be found in Chapter 7).*



The following part of the document contains **a description of the implementation and monitoring**, as well as the **territorial dimension** and **sources of financing** for PEP2040 (Chapters 4-6). Then PEP and SOR strategic projects in the "Energy" area as well as PEP2040 indicators are listed (Chapters 7-8). **Documents related** to PEP2040 at the national and EU level are also indicated (Chapter 9).

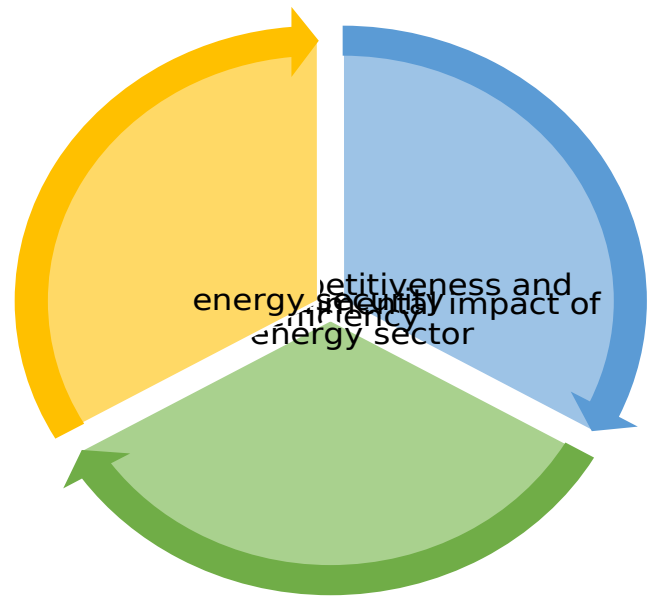
**There are three appendices to PEP2040, forming integral parts thereof:**

1. **Evaluation of the implementation of the previous state energy policy** - the document summarises the implementation of priorities indicated in the *Energy Policy of Poland until 2030* and directions resulting from the *"Energy Security and Environment - prospects to 2020" Strategy*.

2. **Conclusions from forecast analyses for the energy sector** - the document presents a number of forecasts for the fuel and energy sector assuming the implementation of measures determined by PEP2040. In particular, forecasts for primary energy consumption and final energy consumption divided by fuel type and sectors were presented as well as forecasts of electricity generation and installed electrical capacity, power and gas cross-border interconnections, and electricity prices for individual customer groups. Account has been taken also of the capital expenditures necessary to be incurred in the energy sector as well as the forecasts of environmental impact reduction. **The document also contains conclusions from an additional analysis taking account of the forecast of higher CO<sub>2</sub> emission allowance prices and the total cost method.**
3. **Strategic Environmental Assessment of PEP2040** (SEA) - the document presents the analysis of the possible positive and negative environmental impact of the implementation of PEP2040 - in accordance with the *Act on the provision of information on the environment and its protection, public participation in environmental protection and environmental impact assessments*.

## 2.State energy policy objectives

The objective of the state energy policy is **energy security**, while ensuring **competitiveness of the economy**, energy efficiency and **reducing the environmental impact of the energy sector**, with the optimum use of own energy resources.



**Energy security** means satisfying the current and future needs of consumers for fuels and energy in a technically and economically justified manner, while respecting the requirements of environmental protection. This means guaranteeing the current and future security of supply of raw materials, generation, transmission and distribution of energy, i.e. the full energy chain.

The cost of energy lies within every activity and product produced in the economy, thus energy prices translate into **the competitiveness of the whole economy**. At the same time, emissions from the energy sector **affect the environment**, therefore the creation of the energy balance must be done while respecting this aspect.

The following indicators have been assumed as a global measure of PEP2040 target, and a broader list of PEP indicators can be found in Chapter 8.

<p><b>no more than 56% share of coal in electricity generation in 2030</b></p>	<p><b>at least 23% share of RES in gross final energy consumption in 2030</b></p>	<p><b>implementation of nuclear power in 2033</b></p>
<p><b>reduction of GHG emissions by 30% by 2030 (compared to 1990)</b></p>		<p><b>reduction of primary energy consumption by 23% by 2030 (compared to 2007 consumption forecasts)</b></p>

### 3. Specific objectives of PEP2040

## SPECIFIC OBJECTIVE 1. Optimal use of own energy resources

Meeting the demand for primary energy is one of the main elements of the **national energy security**. High efficiency of extraction and use of a raw material results in its more rational management, which contributes to **limiting the environmental impact of the energy sector**. Efficiency of raw material acquisition affects the cost of energy production, which has a further direct impact on the **competitiveness of the economy**.



*Specific Objective 1: Optimal use of own energy resources* has the strongest impact in PEP2040 pillar: **JUST TRANSITION**.

**Pillar I. Just transition**

Changes in the way of using energy resources will be introduced in a rational and gradual manner. Following the transition of the energy sector towards low-emission one, the extraction of energy resources in Poland will decrease. However, this does not mean leaving the coal regions and other areas adversely affected by this economic trend unsupported. Owing to the development of new industries related to e.g. RES and nuclear power, or electromobility, new perspectives for economic development and new jobs will emerge.

The demand for primary energy in Poland is covered by the following energy sources: **hard coal, crude oil, natural gas, lignite and renewable sources**. Poland has resources of all the above mentioned raw materials, however, their quantity and possibilities of use are insufficient to ensure full coverage of the demand<sup>12</sup>. Because of this, Poland has to import part of its energy sources. Forecasts of fuel prices, domestic energy production, as well as energy consumption divided by fuel and carriers are presented in Appendix 2 to PEP2040.

*The strategy for covering domestic demand by individual energy sources is discussed below. The strategic project of this specific objective is the **transition of coal regions**.*

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**hard coal demand coverage**

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<sup>12</sup> PEP2040 is strongly connected with the National Raw Materials Policy (draft), which is aimed at the continuous expansion of the raw materials resource base, including energy sources, and the intensification of activities in the area of exploration, investigation and management (mining) of geothermal water deposits and heat of dry rocks.

The demand for **hard coal** (approx. 69 million t in 2019<sup>13</sup>) is mostly covered by domestic raw material, and domestic resources (deposits located in particular in the Silesian and Lublin basins) allow to cover the demand in the perspective of PEP2040 implementation. The import-export exchange results primarily from the location of demand, availability of raw material of given properties and its price.

**The role of hard coal in the economy will gradually decrease.** The reason for these changes are increasing environmental requirements and decreasing demand for this raw material from the economy (mainly from the electric power sector, but also from households) in connection with the transition to a low-emission one.

**During the transition, it is necessary to ensure stable functioning of the mining industry allowing for reliable supplies of hard coal to the energy sector at competitive prices.** Because of this, a key task is **for mining companies to continuously take measures to improve the efficiency of their operations and the competitiveness of their products.** On the part of the state, it is necessary to monitor the hard coal and lignite mining sector and its restructuring. Mainly the following will contribute to **Increasing the profitability of hard coal mining:**

- rationalisation and optimisation of current operating costs and the sales system, creation of stabilising mechanisms for the time of economic downturn;
- protection of documented mineral deposits and rational management of the extracted deposits, carrying out prospecting and exploratory work and making access to new mining, if it is economically, socially and environmentally justified, implementation of innovative raw material extraction;
- rational distribution of the raw material, i.e. its use at the shortest possible distance from the place of its extraction;
- use or sale of by-products of extraction (methane, hydrogen, minerals) – this will contribute to the implementation of a *circular economy*, while eliminating the costs and negative environmental impact of storing and releasing greenhouse gases (e.g. methane) into the atmosphere<sup>14</sup>;
- commencement of a wide range of research, which gives the possibility to use hard coal deposits in different areas (e.g. urban development, nature preservation), so far uneconomical in traditional mining.

### lignite demand coverage

Demand for **lignite** (approx. 50 million t in 2019<sup>15</sup>) due to its characteristic, is covered in a close vicinity to the place of its extraction (deposits located in central and south-western Poland), therefore there is no market for this raw material. Analogically to hard coal, demand for lignite will decrease. Considerations of the growing environmental requirements and climate policy affect the economic efficiency of the existing lignite-fired power generation units and determine investment processes.

**Therefore, prospective deposits will be secured due to their strategic nature, however, their mining will depend on the decisions of investors. The Złoczew and Ościsłowo deposits are considered prospective and the Gubin deposit is**

<sup>13</sup> *Primary Energy Balance in 2004-2019*, MCE 2020.

<sup>14</sup> For a detailed description of coal mining measures, see *Programme for the coal mining sector in Poland (perspective 2030)*, 2018.

<sup>15</sup> *Primary Energy Balance in 2004-2019*, MCE 2020.

**considered a reserve deposit.** The prices of CO<sub>2</sub> emission allowances, environmental conditions and development of new technologies will play a key role in the management of prospective deposits.

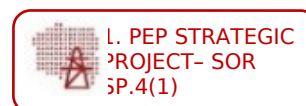
Research and development activities should be aimed at searching for innovations to reduce the environmental burden resulting from lignite extraction and new solutions that contribute to low-emission, efficient and flexible use of the raw material (e.g. gasification, liquid fuels). It also provides the potential for industrial development to satisfy these needs, opening up new economic opportunities<sup>16</sup>.

## transition of coal regions

### Pillar I. Just transition

The reduction or termination of coal mining may lead to **economic and social problems in regions dependent on coal mining and coal-fired power generation.** Therefore, measures are necessary not only in the field of reclamation of mining areas, but also for economic and social transition of entire coal regions, i.e. Silesia, Lower Silesia, Greater Poland, Lesser Poland, and Łódzkie and Lubelskie Voivodships.

It is therefore necessary to implement special development programmes for such regions, e.g. through special support for development projects, the creation of favourable conditions for running and developing business, or additional labour market development mechanisms, and investment in low- and zero-emission generation sources. The transition must be **just**, which means that the negatively affected regions will receive support. The use of EU funds from the Just Transition Mechanism, including the Just Transition Fund, which represents the EU's solidarity in meeting the challenges of the energy transition, will play a particular role in implementing this plan. **For this purpose, a mining restructuring plan and a National Plan for Just Transition will be drawn up in 2021**, followed by relevant territorial plans in the next stage. The measures can count on financial support (e.g. from EU funds) in the total amount of **around PLN 60 billion**. The aid will be provided to the territories most affected by the transition process – in particular in terms of job losses in the fossil fuel production and utilisation sectors and of the need to transform the most emission intensive production processes. The purpose of the undertakings will be to protect employees of the most vulnerable enterprises operating in the areas covered by the plans. In order to best respond to the needs of local communities and economies, representatives of society, local government and mining and energy companies will be involved in the work on the preparation of the aforementioned documents.



Following the above, a **social agreement on the functioning of the mining sector and its transition will be drawn up in 2021**, the scope of which will include:

- a financing mechanism for companies in the hard coal mining sector, including a **new public aid programme for the mining sector**;
- investments in low- and zero-emission energy generation sources with the use of clean coal technologies (including IGCC, CCS, CCU) and using coal for the production of methanol, hydrogen and smokeless fuels, including those implemented by a newly established special purpose vehicle,
- time limits for the termination of hard coal production at individual mines with a view to 2049.

<sup>16</sup> For a detailed description of lignite mining measures, see *Programme for the lignite mining sector in Poland (perspective 2030)*, 2018.

Energy transition is a great economic opportunity for coal regions, and in a broader outlook, also for the whole country. Generating and implementing modern solutions as well as stimulating local industry can be a benchmark for other regions of the country, which are looking for a path of development and use of local potential.

## crude oil demand coverage

### Pillar I. Just transition

Poland does not have rich **crude oil** deposits. Domestic extraction (the deposits are located mainly in the Polish Lowlands, in the Carpathian foreland and on the Baltic Sea shelf) covers only part of demand (approx. 4% of 27 million tonnes annually<sup>17</sup>). Imports come mainly from the East, however the diversification in this area has recently been increasing. Prospecting for new deposits will continue in Poland. The newly discovered deposits will replace extraction from already depleted deposits. Thus, the supply of domestic raw material will remain at a similar level.

**Imports will still be the main method of meeting the crude oil demand.** The main objective will be to diversify the directions and routes of supply and to ensure that the domestic infrastructure is developed to the extent enabling to manage the raw material. High dependence on a single supplier and a single route of supply involves the risk of a failure to supply raw materials in an adequate quantity or of proper quality to the refineries, and thus the occurrence of disruptions in the supply of petroleum products to the market, including fuel. This issue is described in detail further below<sup>18</sup>.

According to sector forecasts, liquid fuel consumption in Poland will remain relatively stable. It is expected that crude oil will continue to be a significant component in the primary energy balance due to the development of transport, and the demand for petrochemicals and new applications. The growth dynamics of the demand for petroleum products will be slowed down due to the development of the use of alternative fuels, including bio-components and hydrogen, as well as the development of electromobility<sup>19</sup>, which positively affect the transition to a low-emission economy, but will also stimulate a new economic area.

## natural gas demand coverage

### Pillar I. Just transition

In recent years, the consumption of natural gas in Poland has been growing and in 2019 it amounted to<sup>20</sup> nearly 18.6 billion m<sup>3</sup>, with domestic extraction (fields are located mainly in the Polish Lowlands and the Carpathian foreland) meeting about 22% of the demand. Demand for natural gas is expected to grow, particularly due to its use in CHP plants and in units ensuring flexibility of the power system, and due to its lower emissions compared to other fossil fuels. Its consumption in the household and transport sectors will increase due to air quality improvement measures.

Due to the availability of the raw material, supply from abroad will continue to be the main source of meeting the demand for natural gas. **Prospecting for new deposits**

<sup>17</sup> *Primary Energy Balance in 2004-2019*, ILEC 2020.

<sup>18</sup> See: Specific Objective 3, Part C.

<sup>19</sup> See: Specific Objective 4, Part C – use of bio-components, development of electromobility and alternative fuels.

<sup>20</sup> *Primary Energy Balance in 2004-2019*, MCE 2020.

(also on the bottom of the Baltic Sea) will be continued to **replace depleted deposits**. The work carried out is expected to contribute to increasing the efficiency of deposit extraction, however, no significant increase in the total volume of domestic production is expected. At the same time, domestic companies should continue to develop their exploration and production activity outside Poland, in particular on the Norwegian Continental Shelf (to which Poland will be connected via the Baltic Pipe in 2022) and in other areas with high resource potential.

It is expected that in addition to traditional natural gas production, **extraction methods allowing to mine unconventional deposits will be developed**. Progress is expected in the extraction of coalbed methane (CBM) gas, both as a result of pre-mining demethanation of coal deposits and as a result of the treatment of surplus methane captured during coal deposit mining, as well as the implementation of effective technologies of capturing ventilation air methane (VAM). The demand for gaseous fuels can also be partially covered by using the domestic production potential of **biogas, biomethane, syngas, synthetic gas or hydrogen**. If relevant technical conditions are met<sup>21</sup>, these gases can be introduced into the gas network, similarly to the mine methane, which will positively affect the increase of their use. Further research on the possibility of extracting gas from unconventional deposits (e.g. shale deposits) is also taken into consideration.

**Since the main way of covering demand for natural gas will be imports**, as in the case of crude oil, the most important is to ensure that the sources and routes of supply are diversified and the domestic infrastructure is developed to the extent enabling the management of the raw material. This issue is described in detail further below<sup>22</sup>.

## biomass demand coverage

### Pillar I. Just transition

Biomass is the only renewable resource constituting a raw material<sup>23</sup>. The **energetic use of biomass**, both thermal and anaerobic (biogas) in biogas plants and for biofuel production, **will increase**. The reason for such development of biomass is the increasing stream of biowaste resulting from growing consumption as well as tightening of waste management regulations which gradually limit landfilling of biowaste<sup>24</sup>. The energetic use of biomass is part of the idea of a *circular economy*.

Particularly the energy sector should utilise **waste biomass** which is cannot be used in other sectors of the economy, e.g. biodegradable municipal waste, sewage waste,

<sup>21</sup> See: Specific Objective 4, Part B - increasing the possibility of transporting other gases

<sup>22</sup> See direction 3, Part B.

<sup>23</sup> Only in the case of biomass/biogas there is an import/export dilemma, therefore other RES are not included in this part of the document. However, location considerations for individual types of RES are characterised in order to provide a diagnostic value. The availability of biomass and biogas is relatively evenly distributed across the country, however their local availability is a key determinant. Solar power potential is distributed similarly across the country, although slightly better conditions are present in the southern and south-eastern parts of the country. The best wind conditions occur in the Greater Poland belt and in Pomerania, and the highest wind speeds are reached in the Baltic Sea. Geothermal resources in Poland are associated mainly with the occurrence of thermal waters, which are present in a considerable part of the Polish Lowlands, as well as in the Carpathians and their foreland and in the Sudetes. Poland's hydrological resources are among the scarcest in Europe and the small differences in altitude make the country's hydropower potential relatively small, although it should be noted that the retention function is key for potential hydrological structures.

<sup>24</sup> As of 2016, it is already prohibited to landfill certain fractions of municipal waste and waste originating from its processing, including waste with a total organic carbon content above 5% of dry weight and a calorific value above 6 MJ/kg of dry weight.







forestry residues and residues from the agri-food or processing industry (furniture, paper, etc.). The process must be carried out in compliance with the principle of hierarchical waste management, which means that biomass should be subjected first to recycling and, if this is not possible, to recovery and disposal, which enables rational management of the biodegradable fraction.







Agricultural biomass will continue to play a large role in meeting the demand for raw material, and it is crucial that there is no raw material competition between the energy sector and agriculture, agri-food and processing industries. Furthermore, biomass should be **utilised as close as possible** to its **place of origin** so that its transport, including the related emissions and costs, does not adversely affect the environmental and economic effect.



**TERRITORIAL**

The regional approach to the specific objective under analysis is closely related to the location of deposits of individual raw materials. Often the extraction of a raw material is of significant importance for the economic and social situation of the particular region. Consequently, when there are plans for reducing the extraction of a deposit, it is necessary to introduce adequate **development policies** for the affected regions. The aim is to minimise the risk of social and economic problems in the region. In many cases, it will be possible to use land for new economic uses after the extraction has been terminated.

 Measures	Date	Responsible entities
 <p>1.1 Ensuring that the demand for hard coal can be met by:</p> <ul style="list-style-type: none"> <li>– ensuring the profitability of the hard coal mining sector;</li> <li>– protecting documented mineral deposits and rational deposit management;</li> <li>– rational raw material distribution;</li> <li>– utilising mining by-products;</li> <li>– seeking innovation in the extraction and use of the raw material</li> </ul>	the whole perspective of PEP2040	coal mining companies, MAP, MKiŚ, PIG-PIB and other research institutes
 <p>1.2 Ensuring that the demand for lignite can be met by:</p> <ul style="list-style-type: none"> <li>– protecting documented mineral deposits and rational deposit management;</li> <li>– seeking innovation in the use of the raw material</li> </ul>	the whole perspective of PEP2040	MKiŚ, PIG-PIB, coal/energy companies
 <p>1.3 Providing support for the transition of coal regions, including drawing up a mining restructuring plan and a National Plan for Just Transition using EU funds in 2021</p> <div style="border: 1px solid red; padding: 2px; display: inline-block; margin-top: 5px;"> <span style="color: red; font-weight: bold;">1. PEP STRATEGIC PROJECT</span>  </div>	the whole perspective of PEP2040	MAP, MKiŚ, MFiPR, local governments, coal/energy companies
 <p>1.4 Ensuring that crude oil demand can be met by:</p> <ul style="list-style-type: none"> <li>– optimising the use of domestic crude oil</li> </ul>	the whole	MKiŚ, PRSIE, oil companies, PIG-

	<p>deposits;          – diversifying the supply sources and directions of crude oil imports;          – using bio-components and alternative fuels as well as biomethane</p>	<p>perspective of PEP2040</p>	<p>PIB, MRiRW</p>
	<p>1.5 Ensuring that natural gas demand can be met by:          – optimising the use of domestic natural gas deposits, including developing the methods of use of unconventional resources;          – diversifying natural gas supply sources;          – using domestic potential for the production of biogas, biomethane, syngas, synthetic gas, hydrogen</p>	<p>the whole perspective of PEP2040</p>	<p>MKiŚ, PRSIE, PIG-PIB, gas companies</p>
	<p>1.6 Ensuring that biomass demand can be met, assuming the local use of raw materials and using the potential of biomass originating from waste</p>	<p>the whole perspective of PEP2040</p>	<p>MKiŚ, MRiRW, PIG-PIB</p>
<p> – energy security, environmental impact       – economic competitiveness,       – reduction of the sector's</p>			

## SPECIFIC OBJECTIVE 2.

# Expansion of electricity generation and grid infrastructure

In order to ensure **security of electricity supply**, it is necessary to upgrade, maintain and extend the generation and grid (transmission and distribution) infrastructure, as well as to secure the systems in terms of cyber security. The shape of the energy mix and providing adequate condition and size of the grid infrastructure allows to increase the **competitiveness of the entire state economy**. The same factors also determine the extent of the **environmental impact of the energy sector**.



*Specific Objective 2. The development of electricity generation and grid infrastructure is in line with all three pillars of PEP2040, but mainly in the **ZERO-EMISSION ENERGY SYSTEM** pillar. As regards the energy sector, the remaining two pillars are presented in PEP2040's specific objectives 4A, 5 and 6, which correspond to this part. Expanding the generation infrastructure with low-emission sources, in particular nuclear and RES, will allow the transition of the electric power sector towards a more sustainable and less carbon-intensive economy. Whereas, the expansion of grid infrastructure will enable to use electricity generated from low-emission sources across Poland.*

**Pillar II. Zero-emission energy system**

\* \* \*

### **PART A) Expansion of electricity generation infrastructure**

In 2019, the Polish economy consumed nearly 170 TWh of electricity, mostly using domestic production, which has increased by about 16% since 1990 and more than 17-fold since the mid-20th century. The installed capacity in the national power system (NPS) was nearly 46.8 GW gross at the end of 2019, of which nearly 36.7 GW are utility power plants based mostly on hard coal and lignite and, in a smaller part, on gas and hydropower. The capacity installed in RES (mainly wind power) amounted to about 7.5 GW and the rest were industrial power plants (various fuels) – about 2.6 GW<sup>25</sup>.

Currently, Poland can fully meet its electricity demand with domestic generation sources, however, in the next several years (particularly after 2029) **a significant part of currently operated generation units will be withdrawn from the power system**. In 2020 alone, about 2.5 GW of capacity installed in centrally dispatched generation units (JWCDs) will be decommissioned<sup>26</sup>. The reasons for the decommissioning of the generation units include the lack of possibility or justification for adjustment to the

<sup>25</sup> Source: *Annual report on the operation of the NPS in 2019*, PSE S.A.

<sup>26</sup> In 2019-2020, approx. 4.2 GW of new coal- or natural gas-fired JWCD generation capacity will be connected to the NPS, which will compensate for the decommissioned units and cover the increase in energy demand. More can be found in Appendix 1 and 2 to PEP2040.

increasingly tighter environmental requirements resulting from, among others, the BAT Conclusions, as well as the age and level of wear of the units and the economic efficiency level of the operation of individual units. Following the growing demand for electricity, related, among others, to the electrification of further sectors of the economy (e.g. transport and district heating), there is a need to expand the generation infrastructure. Whereas, increasing environmental requirements point to the need for investment in low-emission generation sources. With a view **to 2040, an almost new power system will be built** with a strong base of zero-emission sources.

*Below, there is an overview of the considerations for the operation of the power system and a description of the method for meeting the national demand for electricity. The PEP strategic project in Part A of this detailed objective is the **capacity market**, which is at the same time an SOR strategic project in the area of intervention: Improvement of national energy security – SP.1(1).*



\* \* \*

The manner in which the **transition of the electricity generation system in Poland** will be carried out must take into account a number of factors:

– **current balance of electricity production and generation capacity**

Currently, the electricity generation sector in Poland is based mainly on conventional centrally dispatched generation units, generating electricity from coal. These units are carbon-intensive, so the energy transition to low-emission requires a wide range of changes in the structure of electricity generation. Although the units in operation meet the emission requirements resulting from national and EU environmental regulations, their energy production is relatively high CO<sub>2</sub> emission-intensive, which burdens them with high costs of the EU ETS system (*European Union Emissions Trading System*).

– **the European Union's climate and energy policy and difficulties in financing investments using fossil fuels**

Poland contributes to EU objectives and fulfils other international obligations. It should be expected that the decisions concerning the tightening of emission standards and the reform of the EU's CO<sub>2</sub> emissions trading system (EU ETS), as well as the necessity to adjust the generation units to environmental regulations (IED Directive and BAT Conclusions), will result in the increase in costs of using fossil fuels for energy purposes. In order to operationalise climate and energy policy at the EU level, new rules for project financing are being implemented, impeding investment in fossil fuels. This affects not only the availability of EU funds, but also the private ones. Difficult access to capital for investments related to gas infrastructure may create unfavourable conditions for the energy transition in Poland, as the use of natural gas as the bridge fuel enables a secure increase of RES volumes in the NPS until new technologies (including widely used electricity storage) and grid flexibility services are developed.

At the same time, in order to help industry and energy sub-sectors overcome the innovation and investment challenges of the transition to a low-emission economy, it is important to make the best use of the available support mechanisms (including the tools available under the EU ETS, i.e. the Innovation Fund, the Modernisation Fund, the Energy Transition Facility, as well as the EU's Recovery and Resilience Facility following the COVID crisis and supporting a just energy transition). Changes in the current structure of electric power sector companies may prove beneficial to increasing the possibility of mobilising capital and external financing. Companies focused on selected branches of the electric power sector may have greater

opportunities for growth in areas such as research and development and new technologies, as well as greater opportunities for financing.

– **establishment of a single EU electricity market**

In 2018-2019, the *Clean Energy for All Europeans* regulatory package was adopted, which is another package of regulations liberalising the energy market and the main tool for implementing the EU climate and energy policy. The provisions relating to the electric power sector are of great importance for the rules of functioning of the entire electric power sector, and their implementation is aimed, among others, at establishing a single internal electricity market.

– **security of supply and flexibility of production**

In recent years, the electricity market has been strongly modified by the rapid growth of RES characterized by high instability of operation. The operation of conventional sources has become partially dependent on unstable RES, which have the priority of introducing generated energy into the grid. The operating time of conventional units is shorter than it was a few or more years ago, which affects both the economic optimisation of the operation of these units and their technical capabilities. Changes in energy market regulations as well as the progressing share of non-controllable RES in the energy generation structure necessitate the need to ensure the flexibility of the power system.

- **dynamic development of distributed generation**

Owing to intensified support instruments, the amount of capacity installed in RES (including microgrids) is constantly growing. In the coming decades, distributed sources will become a significant element of the NPS' transition and the strengthening of energy security. Until storage technologies become sufficiently developed, generation capacity whose generation will ensure security of supply corresponding to energy demand will still be required in the NPS. A further increase in the role of distributed generation sources is inseparably linked to the need to develop smart grid infrastructure and implement grid management tools and other digital technologies.

– **need to implement innovation**

New solutions should contribute to better efficiency of the power system and easier integration of RES, as well as widely understood reduction of the sector's impact on the environment and increased energy efficiency. Therefore, research and development as well as raising relevant funds play a large role in the implementation of innovations.

– **ensuring a high level of cyber security**

The implementation of new technologies involves many challenges and threats originating in cyberspace. Therefore, it is necessary to include cyber security in the processes of electricity generation and implement appropriate auxiliary solutions to secure the transmission and distribution infrastructure and data flow.

In order to ensure transition of the electricity generation sector, while ensuring energy security, competitiveness of the economy and improvement of energy efficiency, as well as reducing the environmental impact of the energy sector, the Government will support the implementation of the assumptions adopted below, whose operationalisation is also included in the remaining detailed objectives in the document.

Poland will attempt to **ensure the ability to meet its power demand using domestic sources** while allowing for free cross-border exchange. In order to meet the growing demand in a situation of withdrawal of a signifying number of generation units from the power system and to balance the increase of generation capacity depending on weather conditions, Poland has introduced a capacity mechanism – the capacity market. It provides an investment stimulus for the construction and upgrading of generation, storage and DSR (demand side response) units to ensure stability of electricity supply.

**power demand coverage and system flexibility**

**Pillar II. Zero-emission energy system**

The **capacity market**, established in 2017, is a market mechanism that aims to ensure the required level of security of electricity supply while minimising costs from the perspective of economy. It operates in parallel to the electricity market and does not introduce restrictions on shaping prices in the electricity market. It is technologically neutral, so it creates uniform conditions of competition for all electricity generation technologies, electricity storage systems and for capacity demand reduction (DSR) services, taking into consideration the extent to which individual technologies contribute to security of supply and provided that the requirements of the capacity market Act are met.

2A. PEP STRATEGIC PROJECT- SOR 3P.1(1)

The implementation of the capacity market and its operation from 2021 onwards requires to conduct main and supplementary auctions for energy supply in time. The energy market is constantly monitored, which provides the basis for determining the parameters of future auctions, while balance analyses and market development forecasts performed two years prior to the last main capacity market auction (2023) will serve to decide whether it is necessary to continue the operation of the capacity market in view of the EU regulations in force at the time. The capacity market mechanism will also be modified to adjust it to the provisions of the EU's Regulation (2019/943) on the internal electricity market.

Following the introduction of the capacity market mechanism, Poland undertook to remove a number of other mechanisms used to improve the availability of capacity in the system as of 01.01.2021, namely: Intervention Reserve (Interwencyjna Rezerwa Mocy - IRZ), Intervention Operation (PI - Praca Interwencyjna), Guaranteed Intervention DSR Programme, and Operating Reserve (ORM - Operacyjna Rezerwa Mocy). These mechanisms will be replaced by an administrative mechanism of capacity *scarcity pricing*, i.e. a mechanism ensuring a price supplement to the energy price in the balancing market which will depend on factors such as the current volume of operating reserve in the power system.<sup>27</sup>

In addition to electricity supply reliability, the power generation structure must also take the **flexibility needs of the power system** into consideration. Thus, a greater technological diversity, the use of the potential of demand side response (DSR) and other services that can provide greater network flexibility are needed. Because of the foregoing, the importance of generating units with a wide range of generation flexibility (i.e. adapted to rapid load changes as much as possible while maintaining technical conditions for safe operation) will increase. At present, this largely the role of coal-fired power plants, pumped storage power plants, but also generation units based on gaseous fuels (increasingly also gas and biogas sources, operating in cogeneration).

In order to increase the flexibility of the power system, it will be crucial to **develop energy storage technologies**. This is particularly important also for increasing the

<sup>27</sup> See also: Specific Objective 4A.

possibility of integrating RES in the system, as it will enable to store excess electricity and use it later<sup>28</sup>. **Research and development activities in the area of new technologies and innovative solutions** may be critical for changing the structure of power generation and increasing the flexibility of the power system. Economically efficient use of hydrogen on a large scale or other solutions converting electric energy into energy carriers and energy-intensive chemical products (*power-to-X* conversion), arising particularly at RES, chemical and refining industry facilities and electric power, gas and district heating infrastructure, can revolutionise the functioning of the NPS. With a view to 2030, with proper technological development it will be possible to use 2-4 GW of power from RES plants to produce green hydrogen.

**reduction of  
pollutant  
emissions  
from the  
sector**

***Pillar II. Zero-  
emission energy  
system***

In the era of tightening environmental requirements for the energy sector, the need to reduce environmental impact becomes a key determinant of shaping the structure of electricity generation and thus of the energy transition. **The reduction of pollutant emissions from the electric power sector** will be done, in particular, through:

- upgrading electricity generation units and decommissioning of units exceeding emission standards (including the use of EU ETS support mechanisms);
- implementing nuclear power and increasing the use of renewable energy sources;
- increasing the use of cogeneration units;
- increasing the use of other low-emission energy sources and implementing modern technologies;
- improving energy efficiency.

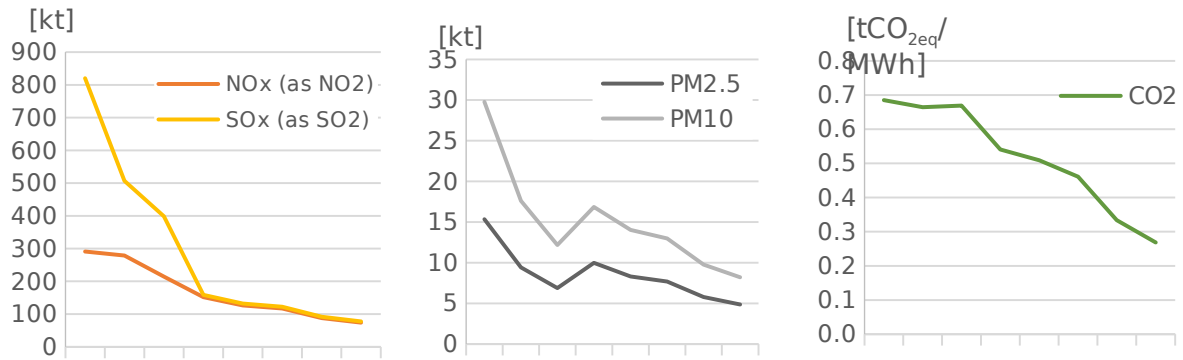
The implementation of PEP2040 will result in significant decreases in emissions of electricity and heat generation as well as emissions of air pollutants, i.e. NO<sub>x</sub>, SO<sub>x</sub>, and dust - all the indicators will be lower by 61-91% in 2040 compared to 2005, and in 2020-2040 they will be reduced by about half.<sup>29</sup>

### **Forecast of pollutant emissions and CO<sub>2</sub> emission intensity for electricity and heat generation**

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<sup>28</sup> See also: Specific Objective 2B - electricity storage and recuperation development

<sup>29</sup> For detailed data see Appendix 2.



Source: own study by the Ministry of Climate on the basis of forecasts from Appendix 2, historical data of KOBIZE

Due to the current level of coal use and its role in ensuring energy security as well as the potential of clean coal technologies, this raw material will have a significant impact on Poland's energy balance. However, the total share of coal in net electricity generation will decline, reaching no more than 56% in 2030.

**the role of coal in the power balance**  
*Pillar II. Zero-emission energy system*

Coal as a fuel will be used mainly in power plants currently under construction or commissioned in recent years, as these units, operating at supercritical parameters, are less carbon-intensive and use fuel more efficiently. In addition, each of these units is built in a *CCS-ready* formula.

Global effects of research and development (R&D) indicate that there is a potential for low- or zero-emission use of coal, which would enable to continue partly the use of coal-fired generating units. Therefore, new methods of coal utilisation and processing will be searched for, researched and implemented, i.e. gasification, oxidation, as well as other clean coal technologies, i.e. carbon dioxide sequestration - *CCS (carbon capture and storage)*, or more broadly - while ensuring useful utilisation of CO<sub>2</sub> - *CCUS (carbon capture, utilisation and storage)*, e.g. in order to increase the use of hydrocarbon deposits.

In view of the desired environmental effect, the absence of the burden of climate and environmental policy costs and the stability of electricity generation, proven **nuclear power** technology will be integrated into the power balance. The first nuclear power plant unit in Poland (with a capacity of approx. 1-1.6 GW) will be commissioned around 2033. The next 5 units with a total capacity of 5-8 GW will be put to service every 2-3 years. There is no nuclear power plant operating in Poland, therefore due to the scale of this undertaking, the *Polish Nuclear Power Programme* was developed and PEP2040 includes a separate specific objective - 5. Implementation of nuclear power.

**the role of nuclear power in the power balance**  
*Pillar II. Zero-emission energy system*

**the role of renewable energy**

The development of **energy from renewable sources** is one of the measures to reduce the environmental impact of energy sector and a key measure for the energy transition of our economy. The adopted target of 23% RES share in gross final energy consumption<sup>30</sup> in 2030 will result in a **min. 32% share of RES in net electricity generation**, and could reach at least 40% in 2040. It is expected that in 2040, the installed capacity using RES could represent about half of all installed generation sources. It should be emphasized that the increase in RES utilisation generates the need for greater flexibility of the power system operation, adaptation and expansion of the transmission and distribution grids. The following RES will be the most important in the electric power sector:

- o construction of **offshore wind power plants** - no offshore wind farm has been commissioned yet in the Baltic Sea in the Polish economic zone, but the relatively high degree of operational stability and capacity utilisation justify the priority development of this technology. The development of this technology is also a strategic direction for the implementation of the European Green Deal. For these reasons, ensuring the conditions for the construction of offshore wind power plants in 2024/2025 has been a strategic project of PEP2040, within specific objective 6.
- o the development of **photovoltaics** - observed and expected further decrease in capital costs of these sources will influence significant increase in their installed capacity. Although the ratio of produced energy to power is small, the correlation between the performance of these units and periods of high demand is high (e.g. summer demand peaks). In order for individual consumers, including renewable energy prosumers, to take benefit from the potential of this technology, the "Mój Prąd" programme was established, which made it possible to multiply the capacity installed in photovoltaic sources within just several months<sup>31</sup>.

In the coming years, **civic distributed power generation** will continue to develop, which will be based on renewable energy sources. This will necessitate adaptation of the grid infrastructure, as well as to develop the market to enable to use the potential of active consumers.<sup>32</sup>

Due to the great expectations of the dynamic pace of RES development, PEP2040 includes a separate specific objective - 6. Development of renewable energy sources. This section of the document also describes the use of other renewable energy technologies.

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<sup>30</sup> Gross final energy consumption comprises electricity consumption, power consumption in the heating and cooling industry and for transport.

<sup>31</sup> As a result of support from differentiated mechanisms, a more than fourteen-fold increase in installed photovoltaic power plant capacity and a more than twelve-fold increase in acquired electricity was observed in 2019 compared to 2015. Compared to 2012, the capacity of these sources increased by 1,184 times, while energy generation increased by 623 times.

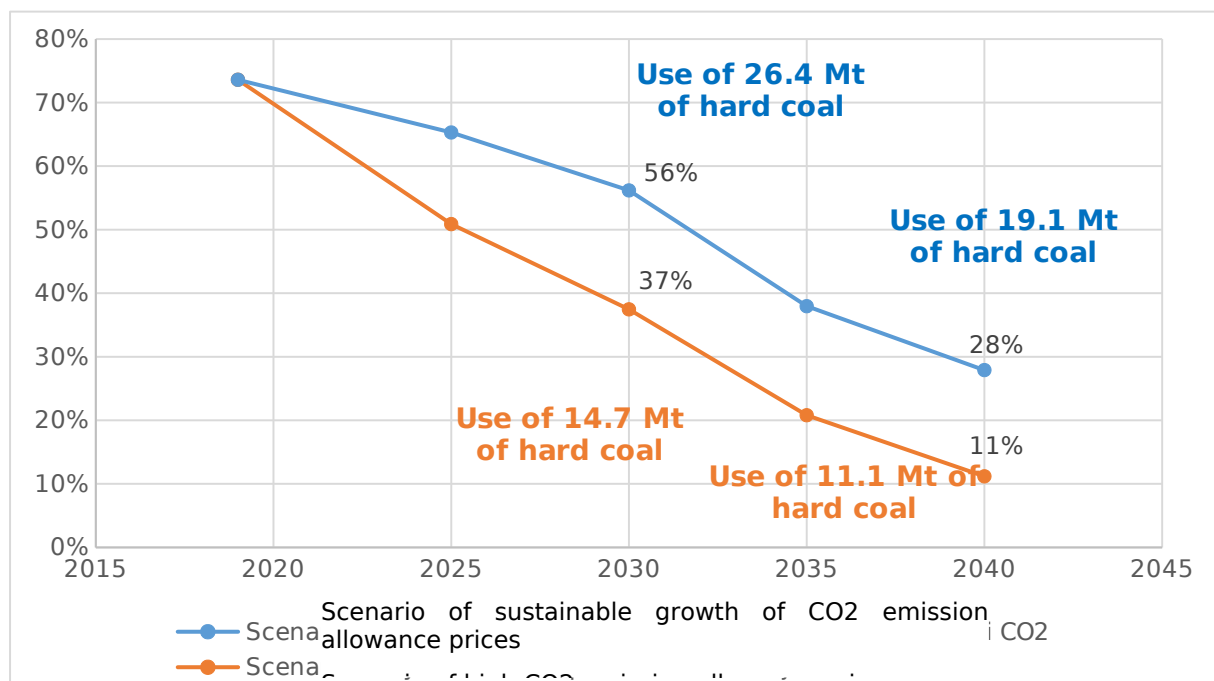
<sup>32</sup> See: Specific Objective 4A.

**Natural gas-fired** generation units will gain in importance in the power balance. These units will be used, among others, for balancing RES units. They have the advantage of lower emissions than coal-fired generation units, and high flexibility in terms of being able to control production volumes. In order to increase the use of gas in the generation of electricity it is necessary to further diversify natural gas supply sources and to develop network infrastructure in Poland.<sup>33</sup> The increased use of natural gas in the power sector will be facilitated by sector coupling, which will be achieved through the necessary cooperation between electricity and gas transmission system operators.<sup>34</sup>

In addition, capacities using other gaseous fuels, such as biogas, biomethane, hydrogen, syngas or synthetic gas, will also become more important. A positive impact on the increase in the use of gases other than natural gas in the power sector may also be exerted by the planned increase in the possibility to transport such gases via networks currently used for the transport of natural gas.<sup>35</sup>

The graph below shows the consumption of hard coal and lignite in electricity generation in the 2040 perspective. More extensive analysis (charts and tables) on the power sector can be found in Appendix 2 to PEP2040.

**Forecast of coal's share in electricity generation by 2040**














Source: own study by the Ministry of Climate on the basis of forecasts from Appendix 2



The location of generating units in Poland depends on fuel availability, site characteristics (e.g. access to cooling water), grid connection conditions and the role of the unit in the power system. The vast majority of the installed capacity volume is located in the southern part of the country (due to fuel availability, among other things), but this trend will change. The development of RES contributes to this, as especially in the north-western part of the country RES sources are being developed owing to good wind conditions. In the coming years, nuclear power units may also be built in this part of Poland. At the same time, the country will be covered relatively evenly by individual generation plants, as well as plants of collective entities (e.g. energy clusters and energy cooperatives). Construction of generation sources in a given location affects the labour market, improves transportation infrastructure, generates tax revenues for local budgets, and raises the overall level of economic development of the region.

<sup>33</sup> See: Specific Objective 3.  
<sup>34</sup> See: Specific Objective 4B.  
<sup>35</sup> See: Specific Objective 4B.

 Measures	Date	Responsible entities
 2A. Ensuring the possibility of covering electricity demand with own raw materials and sources, including cross-border exchange possibilities ( <i>see also: Specific Objective 1</i> )	the whole perspective of PEP2040	MKiŚ, PRSIE, TSOe
 2A. Ensuring that sources other than conventional coal-fired power plants can meet the increase in electricity demand, and providing conditions for the development of the generation capacity structure that guarantee operational flexibility of the power system, including the development of energy storage technologies ( <i>see also: Specific Objective 2, Part B and Specific Objective 4</i> )	the whole perspective of PEP2040	MKiŚ
 2A. Ensuring an adequate volume of stable electricity supply through: – capacity market (since 2021); – making decision on the continuation of the capacity market two years before the last auction (2023), taking into account the limitations resulting from EU regulations	2021/2023	MKiŚ, TSOe
<b>2A. PEP STRATEGIC PROJECT</b>		
 2A. Providing conditions for the reduction of pollutant emissions from the power sector by: – upgrading electricity generation units (including the use of EU ETS support mechanisms);  – increasing the use of zero- and low-emission energy sources;  – improving energy efficiency	the whole perspective of PEP2040	MKiŚ
 2A. Ensuring conditions for the use of coal at a level of no more than 56% net in 2030 in the electricity generation balance	the whole perspective of PEP2040	MKiŚ
 2A. Ensuring conditions for the implementation of nuclear power in 2033 and of the Polish Nuclear Power Programme ( <i>See: Specific Objective 5</i> )	2033	MKiŚ
 2A. Ensuring conditions for RES development at a level that does not threaten the security of system operation, taking into account contribution to the EU-wide target to increase the share of RES in energy consumption ( <i>See: Specific Objective 6</i> )	the whole perspective of PEP2040	MKiŚ, PURE
 2A. Ensuring conditions for the use of natural gas and other gaseous fuels, in particular for the NPS regulation needs ( <i>See: Specific objectives 3, 4</i> )	the whole perspective of PEP2040	MKiŚ, PRSIE

 – energy security, sector's environmental impact

 – economic competitiveness,

 – reduction of the

## PART B) Expansion of power grid infrastructure

Reliability of electricity supply requires appropriate expansion, upgrading and maintenance of the electricity transmission and distribution grid. The key national objectives for electricity transmission infrastructure are to balance electricity supply with demand and to ensure the long-term ability of the power system to meet reasonable demands for the transmission of electricity for domestic and cross-border trade. To ensure the security of supply, the electricity transmission system operator (TSOe) - Polskie Sieci Elektroenergetyczne S.A. (PSE S.A.) will remain a company wholly owned by the State Treasury. Distribution is a regulated activity carried out by more entities, and electricity distribution system operators (DSOe) are required to ensure the reliability of the distribution system, whose task is to deliver electricity to individual end consumers. In order to ensure the security of energy supply to consumers, the TSOe is obliged to prepare 10-year development plans with respect to covering energy demand, while DSOe are obliged to do so for a period of no less than 5 years. In addition, companies designated as key service providers are required to protect critical systems in terms of cyber security.

*Below is a presentation of how the transmission and distribution infrastructure will be expanded, the efficiency of emergency operations, electricity storage and smart grid development. The strategic project of PEP in Part B of this specific objective is the **construction of a smart electricity grid**. At the same time, it is a strategic project of SOR in the area of intervention: Improvement of energy efficiency - SP.2(1).*

\* \* \*

The high and extra-high voltage **transmission grid** consists of over 269 lines with a length of nearly 14,700 km and 107 extra-high voltage substations<sup>36,37</sup>. At present, Poland has two connections with Germany, two with the Czech Republic, one with Slovakia and one connection with Lithuania and Sweden each, and four connections with third countries, three of which are out of operation<sup>38</sup>.

For the proper operation and development of the system in the upcoming years, the TSOe will undertake actions to **upgrade and expand the transmission system**, including:

- ensuring the **ability to connect** the existing generation sources **to the grid**;
- **connecting new generation units**;
- **improving the reliability of supply to consumers**;
- creating safe **conditions of the cooperation of generation units with variable operating characteristics** with other elements of the NPS;
- ensuring the ability to **reduce unplanned energy flows** (the so-called unscheduled flows) from the neighbouring countries and to handle transit transmission;
- ensuring the **ability to exchange capacity with neighbouring systems** on the synchronous profile and coordination and information exchange mechanisms, including optimisation of the methods for sharing (determination and allocation) transmission capacity based on physical flows of electricity (FBA, *flow-based allocation*);

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<sup>36</sup> Data from PSE S.A.

<sup>37</sup> The transmission grid has a mesh character, which means that in the case of a failure of one line it is possible to supply electricity to the distribution substation by another line from a different direction.

<sup>38</sup> The only active connection with a third country is Poland-Ukraine (Zamość-Dobrotwór), in which cross-border capacity is allocated only in the import direction to Poland. Other connections with third countries (Ukraine and Belarus) are not in operation.

- **implementing the EU single electricity market** – implementation of European legislation and accompanying documents;
- implementing standards related to ensuring **cyber security** at the national level;
- increasing the energy efficiency of energy transmission.

**development of  
the national  
electricity  
transmission  
infrastructure**

*Pillar II. Zero-emission  
energy system*

In order to achieve the above objectives over the entire time horizon, the TSOs will carry out activities consisting in the construction, development and upgrading of substations, switching stations, lines and other equipment, including reactive power compensation equipment, at high and extra-high voltages (110-220-400 kV). As a result of the implementation of investment programs in the 2030 perspective, the following should be provided in the first place<sup>39</sup>:

- the ability to connect the existing and constructed conventional power plants to the grid;
- expansion of the transmission grid in the northern and north-western parts of Poland (to integrate significant wind power plants in these areas and to connect offshore wind farms and the nuclear power plant to the grid), in the north-eastern parts of Poland and above and below the arbitrary line between Warszawa and Poznań;
- better use of cross-border interconnections (to improve the conditions of cross-border exchange on the synchronous profile – Poland-Germany-Czech Republic-Slovakia);
- the possibility of using the constructed Poland-Lithuania DC link (*Harmony Link* submarine cable).

**secure use of  
cross-border power  
interconnections**

*Pillar II. Zero-emission  
energy system*

In addition to activities aimed at improving the flow on the existing cross-border interconnections, noteworthy is the **construction of a new submarine cable connection between Poland and Lithuania - Harmony Link**, which is an integral part of a large project of priority importance to the European Union, involving the synchronisation of the electricity transmission systems of the Baltic countries with the system of continental Europe – through the Polish system. *The projected transmission interconnection capacity until 2040 can be found in Chapter 12 of Appendix 2 to PEP2040.* As a result of the modernisation work and development of the power **transmission infrastructure, the level of transmission capacities available for cross-border exchange will increase.** According to the EU Market Regulation (2019/943), at the latest by the end of 2025, transmission system operators are required to make available a minimum of 70% of cross-border capacity (while respecting the criteria for secure operation of the electricity grid). In 2019, Poland has prepared an

<sup>39</sup> Find more in: *Development plan for meeting current and future electricity demand in 2021-2030*, PSE S.A. 2020.

**Action Plan**, which presents a plan and timetable of measures to be taken to gradually increase the provision of cross-border transmission capacity for the purposes of trade.<sup>40</sup>

Cross-border interconnections should provide an additional source of supply for market development, reduction of energy prices and supply in the event of risks and constraints. Cross-border exchanges of electricity shall take place in conditions of secure operation of the power system (e.g. by ensuring an appropriate amount of countermeasures enabling secure operation of the grid in the conditions of occurrence of events such as unplanned circular flows or secure execution of energy transit). Increasing the capacity of cross-border interconnections between Member States should be done first of all by making optimal use of existing interconnections and removing barriers for market participants to access the grid, including the construction of missing lines inside national systems, changing the rules for making transmission capacity available between EU Member States, optimising the methods of making this capacity available to market participants (introducing the method of determining transmission capacity based on physical flows – FBA) and using phase shifters. The benefits of gradually increasing cross-border exchange capacity are an important element of market development, however the security of electricity supply **should be based on a developed national generation infrastructure**.

**development of  
electricity  
distribution**

**Pillar II. Zero-emission  
energy system**

Then, the security of **electricity supply to end consumers** depends on efficient and safe **distribution**. The distribution grid is mainly radial, is longer and much denser than the transmission grid and hence more prone to failures. It consists mainly of 110 kV lines (a grid of high voltage (HV) lines operating in a mesh configuration), a grid of medium voltage (MV) and low voltage (LV) lines operating in a radial configuration, as well as nearly 260 thousand substations. Distribution systems are of regional importance. The 110 kV grid is key importance for the **economic development of individual regions** (power supply to industry, grid connection of large renewable sources), which provides the basis for the operational security of the distribution system and is a grid coordinated with the transmission grid and also used in crisis management. The greatest impact on the reliability of energy supply to end consumers is caused by events in the MV grid, which in 74% consists of overhead lines<sup>41</sup>.

In order to ensure stable deliveries of electricity to end consumers, DSOe **pursue objectives and tasks resulting from the quality regulation** determined by the President of the Energy Regulatory Office (PURE). Since 2018, the regulation mechanism takes into account both weather anomalies as well as the diversity of areas (large cities, cities with county rights, towns, and villages) and the current level of development in a given DSOe's area, which allows for better insight into the DSOe's operations. The following tasks should be implemented in a long-term perspective:

- **The indicators of the quality of energy supply, i.e. the duration and frequency of interruptions (SAIDI, SAIFI) in the NPS should steadily improve** – for SAIDI the target has been set at 85 min. per consumer in 2030.<sup>42</sup> **Furthermore 85% of grid**

<sup>40</sup> See also: Specific Objective 4A. Development of electricity market.

<sup>41</sup> Based on data from the Polish Society for Transmission and Distribution of Electricity.

<sup>42</sup> The SOR set a target of 50 min. per consumer in 2030, however due to a re-examination of technical feasibility this number has increased.

**connection agreements should be performed within 12 months by 2025** and the time for transmission of metering and billing data should be shortened.

- The achievement of quality regulation targets is closely linked to the funds that the DSOe can allocate for investment in the following year. Much of the distribution infrastructure is over 25 years old, and in many cases even more than 40 years old (although DSOe have made large investments in recent years). For this reason, DSOe are obliged to reconstruct the grid – **the infrastructure reconstruction rate should be at least 1.5% per year** until the average age of the infrastructure is below 25 years.
- **The reconstruction of low-voltage (LV) lines** should be done with insulated conductors or by means of cabling.
- **Medium voltage (MV) line cabling** is strongly correlated with SAIDI and SAIFI, and the share of cable lines in MV lines in Poland (about 26% in 2017) is one of the lowest in Europe. Over 41,000 km of MV overhead lines are located in forests and wooded areas, where the cabling is particularly important for reducing the causes and consequences of failures. Furthermore, equipping medium voltage line switches with remote control systems is also considered a priority. In order to achieve higher grid operation reliability, it is necessary to successively cable the medium voltage grid. For this purpose, in 2021 a **national plan for the cabling of medium voltage grids until 2040** will be drawn up and its implementation will result in increasing the share of cable lines in MV lines in Poland to the EU average.

Growing share of renewable energy sources, increasing number of renewable energy prosumers, popularisation of energy clusters, energy cooperatives or civic energy communities **requires adjustment of distribution systems** to the trend of decentralisation of generation and increasing the role of the local dimension of the energy sector. In addition, the development of electromobility, which generates the need to ensure the possibility of connecting charging points for electric cars to the grid, is also a challenge. **In order to ensure the conditions for system development, the investments carried out in the distribution systems will contribute to the gradual transition of the passive grid (one-way) into an active grid (two-way)**, which, along with the implemented solutions for the grid flexibility improvement, will enable the development of distributed generation, active participation of end consumers and the use of charging points and energy storage facilities. To this end, it is also necessary to develop the cooperation between DSOe and the TSOe even more strongly.

**efficiency of  
operations in  
emergency  
situations**

**Pillar II. Zero-emission  
energy system**

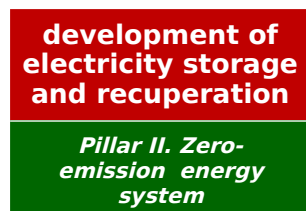
Ensuring the security of electricity supply also requires readiness to act **in emergency situations** in the power system. In 2018, DSOe and the TSOe have signed an agreement to cooperate in such cases, but the following actions are necessary for the highest possible level of efficiency in emergency situations:

- increasing the use of **elements of control and automatic reconfiguration** in medium voltage grids (by 2025 and 2030 respectively);
- equipping MV and LV systems and lines **with grid operation diagnostics and analysis equipment** (by 2025 and 2030, respectively);

- implementation of a **digital network communication system for DSOe** (by 2021) – the analogue system currently in use is unreliable and there is no possibility of its expansion – the new one should guarantee the uniformity and reliability of communication;
- providing an adequate structure to support the handling of cyber incidents, and cooperating with the relevant National Computer Security Incident Response Team (CSIRT);
- ensuring a **number of employees and equipment by DSOe, sufficient to meet the standards** specified in the regulations on the conditions of operation of the power system.<sup>43</sup>

Dynamic changes in the energy market in recent years require greater efforts from operators – both the transmission operator and the distribution operators. The increased probability and scale of system operation disturbances determines the need for better ongoing monitoring of electricity quality parameters. For this reason, by 2025 a **system for monitoring and managing the quality of electricity in power grids, including billing systems for the quality of supplied electricity** will be implemented in the NPS.

Investments in both transmission and distribution networks require appropriate sources of financing and regulations that ensure efficient implementation of these investments. Therefore, it is necessary to ensure a stable regulatory environment **that will allow proper planning of network development and investment**. In order to effectively carry out investment tasks with a linear structure in the distribution grid, it is also necessary to introduce legal regulations facilitating the acquisition of rights to use real property for construction purposes for the electric power infrastructure.



Due to the growing volume of RES connected to the distribution and transmission grid, growing importance of distributed generation, changing the profile of electricity consumption (including the development of electromobility), the need to develop the **energy storage** technology is growing.

High hopes are placed on the **development of electromobility** and the wider use of **energy recuperation from electric vehicles powered by a traction power network**. Research on batteries that power electric cars will advance energy storage technology, and electric cars could act as energy storage in the future. As part of activities aimed at the development of charging infrastructure, V2G (vehicle to grid) technology will be supported, which enables a two-way flow of electricity, including its return by electric vehicles in order to stabilise grid operation.

DSOe are collaborating internationally in research projects focused on the development of long-discharge storage technologies. It is necessary to **regulate the legal status of electricity storage facilities** that can provide services to electricity market participants – the key issue in this regard is to determine preferential tariffs for energy introduction

<sup>43</sup> Although the condition of adequate employment level applies to all areas discussed in PEP2040, distribution needs to be stressed, as in recent years the low number of job candidates has been a significant problem for DSOe.

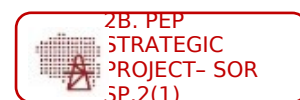
into storage, which will also affect the possibility of changing the operation model of pumped storage hydroelectric power plants. Nonetheless, having energy storage in technologies other than pumped storage power plants storing capacity equivalent to 10% of installed wind capacity in the 2023 perspective is an ambitious goal<sup>44</sup>.

It is also desirable to **develop other solutions that will enable progress in energy storage (electricity and heat)**, especially such that would allow to use energy from RES. Besides biogas, which enables a rapid response to the system needs, it is worth using surplus energy from intermittent RES to produce fuel that can be practically stored. Increasing the cost-effectiveness of the production and **use of hydrogen**, which has a high energy density and also allows for a relatively long fuel storage period and the possibility of rapid utilisation for system needs, can play a large role in this regard. *Power-to-gas* plants, which convert electricity into hydrogen by electrolysis, will enable to use surplus energy from renewable sources as a kind of an energy storage system. The use of electrolyzers (P2H/P2G/P2L/P2A/P2X systems) will allow integration of the gas system with the power grid in accordance with the *sector coupling* concept. An opportunity in the field of energy storage may also turn out to be the progress in increasing the profitability of coal gasification, which used in this technology is characterised by emissions significantly lower than in the case of conventional combustion. The search for innovations in increasing the flexibility of power system operation is highly desirable for its proper functioning and for the development of renewable energy sources. Subsequently, regulations necessary for regulating the legal status of the aforementioned storage technologies will be implemented.

### development of smart grids

#### Pillar II. Zero- emission energy system

**The construction of a smart grid** will be the culmination of activities to develop the national electricity grid. The foundation for development is information and communication technology (ICT) solutions. In addition to two-way digital communication systems, these include smart metering systems, systems for automatic monitoring, control, regulation and grid protection, also in the context of cyber security, and metering systems (including smart metering) for the flow of power and energy data that are the basis for taking pro-efficiency measures.



An important stage will be the creation of technical, organisational and legal conditions for the operation and **establishment of an energy market information operator (OIRE)**. The second important element is equipping end consumers with remote reading meters – by 2028 80% of households should be equipped with such devices.<sup>45</sup>

The established entity-neutral register of metering information of the electricity market, transparency of processes, establishment of uniform rules of access to data and transparency of the division of responsibilities among market participants will facilitate the management of electricity supply and demand and will result in reducing losses, with a high level of quality, reliability and security of power supply. Data availability and transparency will also become an opportunity for the development of new services,

<sup>44</sup> See also: Specific Objective 4, Part A – demand management and Specific Objective 4, Part C – development of electromobility and alternative fuels.

<sup>45</sup> See: Specific Objective 4A – empowering the electricity consumer.

products and incentives for end consumers, as well as for the efficient use of energy in public space.

The smart grid will integrate the behaviour and actions of all users connected to it – generators, consumers and prosumers of renewable energy, while OIRE will ensure the exchange of information between system participants. With access to their metering data, consumers will be able to use energy more consciously, which, together with the use of dynamic tariffs, may also contribute to flattening the daily energy demand curve<sup>46</sup>.




The development of a smart grid is an integral part of the development of energy storage, electromobility, better integration of electricity generated by RES units with the system, as well as the popularisation of smart homes, spreading the idea of the so-called Internet of Things (data exchange between devices, i.e. IoT), and smart cities. It is also reasonable to analyse the possibilities of using cooperation with the telecommunications market and infrastructure cooperation.

The implementation of smart metering and further smart grid solutions is a step towards building a new, decentralised energy system in which end consumers will be more active, ancillary services will be purchased from market participants also from the distribution grid level, and consumers will seek to self-balance within self-balancing areas<sup>47</sup>.


















The coverage of the country with the transmission grid and distribution grids is correlated with the volume of electricity demand in a given region and the necessity of the grid connection of generation units, while the exact routing of the lines depends also on the possibility of locating the line infrastructure. The density and the good condition of the grid should guarantee security of electricity supply and failure rate as low as possible, which is independent of the location of the region. The investment programs developed by the TSOe and DSOe are aimed at ensuring security of supply across the country.

The development of energy storage also applies to the whole country – in the long term, every consumer can be equipped with an energy storage system (including an electric car). It is particularly important to locate storage facilities at RES, both weather-dependent and dispatchable, and in energy communities, as this supports the stable operation of the NPS. Successive implementation of smart grid will also have a positive effect on system stability.

 <b>Measures</b>	<b>Date</b>	<b>Responsible entities</b>
 2B.1. Development of the internal electricity transmission grid – investments enabling an increase of the grid density, connection of large power plants to the grid and better use of cross-border interconnections	the whole perspective of PEP2040	TSOe
 2B.2. Strengthening electricity cross-border interconnections on the profile with Germany,	2030	TSOe

<sup>46</sup> See: Specific Objective 4A – demand management.

<sup>47</sup> More on the new energy market design can be found in Specific objective 4A.

Czech Republic, Slovakia			
  	2B. Construction of the Poland-Lithuania submarine connection (Harmony Link) and synchronisation of the Baltic States with the power system of continental Europe	2025	TSOe
  	2B. Improving the quality of energy supply to the consumer – by 2025 by: 4. – completing the goals and objectives of quality regulation; – improving SAIDI and SAIFI indicators; – achieving the performance of 85% of connection agreements within 12 months; – reconstructing infrastructure – at an average rate of 1.5% per year; – drawing up a <i>national plan for MV cabling by 2040</i> (by 2021) and gradually replacing the passive grid by an active one	2025	DSOe, PURE
  	2B. Ensuring conditions for smooth operation in emergency situations, in particular by: 5. – increasing the use of elements of control and automatic reconfiguration in medium voltage grids (2025/2030); – equipping MV and LV systems and lines with grid operation control, diagnostics and analysis equipment (2025/2030); – implementing a digital network communication system in DSOe' grid (2021); – providing resources for proper system operation DSOe	the whole perspective of PEP2040	DSOe
  	2B. Striving for the development of storage technologies, including regulating the legal status of electricity storage facilities in 2021 – <i>allowing to achieve the level of energy storage equal to 10% of the installed wind power capacity in 2023. (ensuring conditions for the development of electromobility in Specific Objective 4C)</i>	the whole perspective of PEP2040	MKiŚ, distribution companies
  	2B. Constructing smart grids – 7. – establishing an energy market information operator; – creating conditions for the functioning of the <i>Internet of Things</i> – <i>equipping 80% of households with remote reading meters by 2028 - Measure 4A.2.</i>	2023 / 2028	MKiŚ, MC, distribution companies

2B. PEP STRATEGIC PROJECT 

 – energy security, environmental impact

 – economic competitiveness,

 – reduction of the sector's

## SPECIFIC OBJECTIVE 3.

# Diversification of supply and development of network infrastructure for natural gas, crude oil and liquid fuels

Natural gas and crude oil are important elements of the balance of primary energy consumption in Poland, and national production of these raw materials meets only part of demand. This is why the **security of supply** of raw materials to the country, and consequently to the consumers, is determined by the diversity of sources, routes, and suppliers, efficient cross-border interconnections (following the establishment of a single energy market), as well as adequately developed internal infrastructure. The high degree of dependence on a single supplier and the lack of diversification options had a negative impact on the competitive development of prices and generated the risk of political pressure. At the same time, increasing the flexibility of access to these fuels for end consumers translates into **the increased competitiveness of the markets**. The increased availability of natural gas on competitive terms will also enable its use in the energy sector, among others, for the purposes of cogeneration and construction of reserve capacity for balancing renewable energy, which will result in **reducing the environmental impact of the energy sector**. Natural gas is a low-emission fuel, the use of which may significantly contribute to the achievement of the EU climate policy objectives, as well as positively counteract air pollution through the reduction of the so-called low-stack emissions.



*Specific Objective 3. Diversification of supply and development of network infrastructure for natural gas, crude oil and liquid fuels* is in line with Pillar II **ZERO-EMISSION ENERGY SYSTEM**.

**Pillar II. Zero-emission energy system**

Natural gas is treated as a transition fuel that will enable the transition of the electricity and heat sectors towards zero-emission generation. Also, the traditional fuels infrastructure is a transitional step towards the widespread use of zero-emission solutions in transport, including electromobility and hydrogen mobility.

*The strategy for ensuring the security of natural gas, crude oil and fuels supply to the country and to end consumers is presented below.*

## PART A) Diversification of natural gas supply and development of gas infrastructure<sup>48</sup>

To secure the supply, the gas transmission system operator (TSOg) – Gas Transmission Operator GAZ-SYSTEM S.A., remains a joint-stock company wholly owned by the State. Gas transmission, distribution and storage are regulated activities. The TSOg, gas distribution system operators (DSOg) and storage system operator (SSOg) – Gas Storage Poland S.A. are obliged to ensure the reliability of system operation and perform other duties that condition the security of supply to consumers and operation of the system and plants. In order to ensure the security of supply to consumers and the development of the system, GAZ-SYSTEM S.A. is obliged to prepare 10-year development plans in terms of satisfying the current and future demand for gaseous fuels, while DSOg are obliged to prepare at least 5-year plans.

Poland is gradually reducing its dependence on natural gas supplies from the East, in favour of a growing volume of liquefied natural gas supplies and as part of intra-Community trade, through supplies from Germany and the Czech Republic (in 2018, almost 81% of the natural gas consumed was imported, with 60% from the East). In mid-2016, a liquefied natural gas (LNG) **regasification terminal** began receiving its first commercial deliveries, which was a huge step toward diversifying both sources and suppliers of gas to Poland. The LNG terminal in Świnoujście receives supplies by sea from Qatar, Norway and the USA. In the coming years, the share of LNG in natural gas consumption may reach up to 30%. The Polish terminal is a key infrastructure facility from the point of view of the security of gas supply not only for Poland but also for the neighbouring countries. This is the only facility of this size in Central Europe, and the importance of LNG trade is growing on the global natural gas market, also due to the increasing price competitiveness in relation to the raw material delivered by pipelines. An important issue is to ensure access to the raw material for end consumers, for which it is necessary to expand the national transmission, distribution and storage infrastructure.<sup>49</sup>

*Below are presented the directions of the diversification of natural gas supply sources, expansion of cross-border connections and the national natural gas transmission, distribution and storage infrastructure. The strategic project of this part of the specific objective is the **construction of the Baltic Pipe**.*



\* \* \*

Following the end of the so-called **Yamal contract<sup>50</sup> at the end of 2022** securing the majority of natural gas supply, actions are taken to ensure a real diversification of supply sources before the beginning of the gas year 2022/2023<sup>51</sup>. In addition to infrastructure measures, it is important for energy companies to continue activities aimed at **contractual diversification of natural gas supply**.

**Further diversification of gas supply sources and directions** will be done through the **expansion of import capacities** and **development of interconnections with neighbouring countries<sup>52</sup>**. This will allow to create conditions for the establishment of a **gas transmission and trade centre** in Poland, for the countries of Central and Eastern

<sup>48</sup> Find more in: *National Ten-Year Network Development Plan 2020-2029*, GAZ-SYSTEM S.A. 2019, *Ten-Year Network Development Plan (TYNDP)*, ENTSO-G 2017.

<sup>49</sup> Data based on statistical research of the Ministry of Economy and Labour.

<sup>50</sup> A contract signed in 1996 between PGNiG and Gazprom for the supply of natural gas to Poland.

<sup>51</sup> The gas year runs from 1 October of year  $n$  to 30 September of year  $n+1$ .

<sup>52</sup> The projected transmission interconnection capacity until 2040 can be found in Chapter 12 of Appendix 2 to PEP2040.

Europe and the Baltic States<sup>53</sup>, as well as to adjust the infrastructure to the dynamically growing demand for natural gas. Poland's favourable geographical location justifies its plans to reach the status of a transit country for the transmission of gas on the east-west and north-south axes. These projects are Poland's contribution to the implementation of the Three Seas Initiative, which aims at deepening the integration of the countries of the Baltic, Adriatic and Black Seas, as well as the **North-South Gas Corridor**<sup>54</sup> for the countries of Central and Eastern Europe (an alternative to the East-West Corridor and reducing dependence on a single gas supplier) **and the Baltic States Energy Integration Plan**, which are priorities for the European Union.

development of natural gas import capacity

Pillar II. Zero-emission energy system

Poland's strategy to increase its import capacity consists primarily of three elements:

- **expansion of the LNG terminal** – in connection with the development of the global LNG market, the terminal is being extended to a throughput (of reception and regasification) of 8.3 billion m<sup>3</sup>/year (current regasification capacity is 5 billion m<sup>3</sup>/year), as well as the range of services offered is extended by LNG bunkering, transferring LNG onto ships and road tankers, which will be completed by 2023. In the 2030 perspective, it is possible to further increase the regasification capacity of the terminal, if such a need arises from market analysis;
- **construction of a natural gas regasification terminal in the Gulf of Gdańsk** (FSRU, *floating storage regasification unit*) – the analysis of designing the new terminal was conducted in view of dynamic growth in demand for natural gas and high level of contracting and utilisation of the Świnoujście terminal, as well as the progressing global revolution on the liquefied gas market. The choice of location results from the expected increase in the demand for gas in the Tri-City and its surroundings, as well as from the need for proper shaping of gas flows in the transmission system, taking into account the large volumes of gas that will be introduced into the gas system in the western part of the country through the Świnoujście LNG terminal the Baltic Pipe. The first stage, providing a capacity of at least 4.5 billion m<sup>3</sup>, is planned for commissioning after 2025. The expansion of the FSRU will depend on market development in the region and growth in demand for natural gas in the country;

- **construction of the Baltic Pipe** – a gas pipeline whose aim is to establish an interconnection between the Polish transmission network and deposits on the Norwegian Continental Shelf<sup>55</sup>. This investment will consist of the construction of Norway-Denmark and Denmark-Poland interconnections (submarine interconnection) and the expansion of the Polish and Danish transmission system. The project will be completed by October 2022, allowing the import of 10 billion m<sup>3</sup> and the export of 3 billion m<sup>3</sup> of natural gas.



<sup>53</sup> The issue of the gas *centre* is described in Specific Objective 4, Part B.

<sup>54</sup> The North-South Gas Corridor will connect the LNG terminal in Świnoujście and the Baltic Pipe through Southern Poland, the Czech Republic, Slovakia and Hungary, with the markets of Southern Europe as part of the Three Seas Initiative concept.

<sup>55</sup> The concept of interconnecting the Danish and Polish systems is included among the objectives of EU energy policy in the *Baltic Energy Market Interconnection Plan* – BEMIP.

**The development of interconnections with neighbouring countries**, together with the development of the national transmission network and the expansion of gas storage facilities, is the second element of the strategy for the diversification of natural gas supplies, which will simultaneously create the conditions for the development of the market and for the rise of Poland's importance as a *regional centre for the natural gas transmission and trade*. At present, besides the supplies to the LNG terminal, Poland receives mainly Russian gas through Belarus and Ukraine and also supplies from Germany and the Czech Republic. In order to increase the possibility of diversification of gas supply and interchange, **the following interconnections are being established:**

– **with Slovakia** - to an import capacity of 5.7 billion m<sup>3</sup> and an export capacity of 4.7 billion m<sup>3</sup> annually),

– **with Lithuania** (GIPL) - to an import capacity of 1.9 billion m<sup>3</sup> and an export capacity of 2.4 billion m<sup>3</sup> annually,

Moreover, **there are projects for new gas interconnections between Poland and the Czech Republic and between Poland and Ukraine**. Decisions on their construction will depend on arrangements with foreign partners and the development of the natural gas market in Poland.

The achievement of cross-border objectives must involve the **simultaneous development of the national network and storage infrastructure**. Only such a developed system makes will allow to: (a) ensure a long-term ability of the gas system to meet reasonable demands for the transmission of gas, and (b) balancing natural gas supply with demand. The investments underway not only meet strategic needs, but also ensure the ability to supply the growing market with raw material.

The length of the natural gas transmission network in Poland is nearly 12,000 km<sup>56</sup>. The national transmission network must enable the full use of import infrastructure. Therefore, it is necessary to **expand the national gas transmission system** - the plan for the coming years focuses on the expansion of the following networks:

- in the western, southern and south-eastern part of Poland (*from Świnoujście to the interconnections with the Czech Republic, Slovakia and Ukraine*) - this will enable transmission of gas from the LNG terminal and the Baltic Pipe to domestic consumers as well as export to the neighbouring countries, and also import of gas from the South from new suppliers;
- in the north-eastern part of Poland (*to the interconnection with Lithuania*) - this will enable the development of gasification in this part of the country and will also strengthen energy integration of the Baltic States with continental Europe;
- in the northern and central part of Poland - this will enable the transmission of gas from FSRUs in the Gulf of Gdańsk to gas pipelines in the central part of the country.

development of cross-border gas interconnections  
Pillar II. Zero-emission energy system

development of the national gas transmission infrastructure  
Pillar II. Zero-emission energy system

development of the national gas distribution infrastructure  
Pillar II. Zero-emission energy system

<sup>56</sup> Data of GAZ-SYSTEM S.A.

An important element of the development of the national network is also the **expansion and upgrading in the area of distribution**. Currently around 65%<sup>57</sup> of communes in Poland have access to natural gas, while the gasification level will increase to around 76% in 2024 and in the following years it should undergo further growth in accordance with the market needs. Particular emphasis was placed on eliminating the so-called "*white spots*" – places without access to raw material. Gasification will be carried out first in the communes in North-Eastern Poland, in the area of Oddział Zakład Gazowniczy Łódź and in the area between Koszalin, Bydgoszcz and Braniew.

In case there is no justification for the construction of a gas pipeline, in order to create "island" distribution zones, projects **using liquefied natural gas regasification stations with local island networks** (the so-called virtual LNG pipelines) will be implemented. Alternatively, these zones can be supplied with biomethane (biogas purified and treated to natural gas quality) from local biogas plants, but also with other locally produced gases. An important factor in this respect will also be achieving, by 2030, the ability to transport a mixture containing around **10% of decarbonised gases**, in particular biomethane and hydrogen<sup>58</sup>, through gas networks. The development of gas storage facilities, described below, will also have a beneficial impact on their utilisation.

Local access to gas makes it possible to use it in district heating, as a low-emission alternative (alongside RES) to individual boilers fired with low-quality solid fuels<sup>59</sup>, in transport and as a reserve for energy from renewable sources whose operation is dependent on weather conditions.

development of  
natural gas  
storage

Pillar II. Zero-  
emission energy  
system

From the point of view of energy security, adequate **storage and off-take capacity from underground gas storage (UGS) facilities** is very important. The storage facilities maintain the required levels of natural gas reserves, which serve among others to meet peak demand for this commodity, as well as to ensure supplies during failures and supply interruptions. Storage facilities can also serve to cover long-term increased demand for natural gas during the winter season. It should also be noted that the expansion of natural gas storage capacity and the use of salt caverns will provide better conditions for the popularisation of the so-called decarbonised gases, i.e. biogas, biomethane and hydrogen. The current total capacity of seven underground high-methane gas storage (UGS) facilities amounts to approx. 3.2 billion m<sup>3</sup>, which constitutes nearly 1/6 of annual domestic consumption, and the diversified geographical location of the existing storage facilities<sup>60</sup> is a definite asset supporting the flexibility of the gas system operation. In order to further increase energy security, it is advisable to **expand UGS to the level of at least 4 billion m<sup>3</sup>** (an increase by 1/3 of the current capacity) and to **increase the current maximum off-take capacity of gas from storage facilities** – from 53.5 million m<sup>3</sup>/day to at least 60 million m<sup>3</sup>/day (an increase by ca. 1/6

<sup>57</sup> Estimation based on the analysis by the Ministry of Climate and Environment.

<sup>58</sup> See: Specific Objective 4, Part B.

<sup>59</sup> See: Specific Objective 7.

<sup>60</sup> High-methane natural gas storage facilities are located in south-western (Wierzchowice) and south-eastern parts of the country (Swarzów, Brzeźnica, Strachocina, Husów near Tarnów and Sanok), in Central Poland (Mogilno) and in the north (Kosakowo).

of the current capacity) by the winter season 2030/2031. The decision on the location of additional UGS capacities will be made on the basis of market analyses taking into account factors such as the technical possibilities of construction/extension and the shape of the mandatory natural gas reserves system.<sup>61</sup>

Investment in gas infrastructure is of great economic importance, but current regulations relating to the investment process prolong its implementation and increase expenditure. It is therefore necessary to ensure a regulatory environment that encourages investment in the development of gas infrastructure. This will be ensured by drawing up a **comprehensive regulation of the investment process and the adoption of a multi-year tariffing model by URE (Energy Regulatory Office)**, which will improve the predictability of the investment process and reduce risks.

**investment incentives**

*Pillar II. Zero-emission energy system*

The EU regulation on security of gas supply (the so-called SoS Regulation) has introduced a **new organisation of the security of gas supply system at the regional level**. In order to enhance the safe operation of European gas systems, a first **plan and risk assessment** based on EU legislation has been developed in 2019. These documents will be updated every 4 years.











**security of supply at regional level**

*Pillar II. Zero-emission energy system*



Diversification efforts in natural gas supply are aimed at ensuring security of supply through the diversion of gas flows from the East to the West and from the North to the South. Increasing the territorial coverage of access to the gas network, thanks to the development of an internal network, will not only result in the economic development potential of a given region, but will also affect the possibility of reducing low-stack emissions. Internal infrastructural investments follow the current and potential demand, but also aim at increasing the uniformity of the country's gas infrastructure coverage so as to eliminate the so-called "white spots" in access to natural gas, particularly in the region of North-Eastern Poland.

<sup>61</sup> Data based on statistical research of the Ministry of Economy and Labour.

 Measures	Date	Responsible entities
 3A.1 Ensuring contractual diversification of natural gas supplies	2022	gas companies
 3A.2 Ensuring the possibility of importing natural gas through the construction of the Baltic Pipe - Norway-Denmark and Denmark-Poland interconnections together with the expansion of the transmission systems in Denmark and Poland	2022	TSOg
<b>3A. PEP STRATEGIC PROJECT</b> 		
 3A.3 Ensuring the possibility of importing natural gas by increasing the regasification capacity of the Świnoujście LNG terminal to 8.3 billion m <sup>3</sup> per year and increasing the flexibility of operation and introducing new functionalities (possibly further expansion depending on market analyses)	2023 (2030)	Polskie LNG S.A., TSOg
 3A.4 Expanding/constructing gas interconnections with the neighbouring countries - Slovakia, Lithuania, possibly the Czech Republic and Ukraine	2022	TSOg
 3A.5 Constructing a floating regasification LNG terminal (FSRU) in the Gulf of Gdańsk	after 2025	TSOg
 3A.6 Developing the gas transmission network: - in Western and Southern Poland - the possibility to transport gas from the LNG terminal and the Baltic Pipe; - in North-Eastern Poland - strengthening integration with Baltic states - in Northern and Central Poland - making it possible to transport gas from the FSRU to the system pipelines located in the central part of the country	2022 (2029)	TSOg
 3A.7 Developing the gas distribution system - reducing <i>white spots</i> , increasing the percentage of gasified communes from 65% to 76% in 2024 and increasing in subsequent years through: o expanding and upgrading the gas distribution network o using LNG regasification stations	2024	DSOg
 3A.8 Expanding UGS to a total storage capacity of at least 4 billion m <sup>3</sup> and gas off-take capacity from these facilities to the level of at least 60 million m <sup>3</sup> /day.	2030	SSOg
 3A.9 Providing a regulatory environment that encourages investment in the development of gas infrastructure (multi-year tariff, streamlining of the investment and construction process)	2021	MKiŚ, MRPiT, URE

■	3A.1 Preparing risk assessments and plans for security of gas supply under Regulation 2017/1938 (updated every 4 years, first in 2023)	2023	MKiŚ, TSOg
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■ - energy security,  
sector's environmental impact

■ - economic competitiveness,

■ - reduction of the

## **PART B) Diversification of oil supplies and development of crude oil and liquid fuel infrastructure<sup>62</sup>**

In view of the scarcity of domestic crude oil resources to date (the raw material produced domestically covers only a small portion of the market needs - 4%), it is crucial from Poland's point of view to work towards diversification of supplies and ensuring security of crude oil and liquid fuels supply. In recent years, Poland has increased its imports from such countries as Saudi Arabia, Norway and the United States, which positively affects the costs of purchase of this raw material and the negotiating position of Polish companies.

**Further diversification of crude oil imports requires, first and foremost, a developed and well-functioning domestic infrastructure** to ensure the possibility of increasing imports by sea. The current condition of the pipeline network and storage capacities makes it possible to cover current needs; however, in the perspective of further market development, it is necessary to ensure the possibility of **increasing the level of storage and separation of various types of crude oil** imported by sea and of efficient and safe transfer to the refinery in Płock. The main objective is to ensure (a) uninterrupted deliveries of crude oil to Polish refineries and (b) supply liquid fuels to the market at a level ensuring its normal functioning in a crisis situation.

*The directions of diversification of directions and crude oil supplies through the expansion of transmission and storage infrastructure for crude oil and liquid fuels are presented below.*

*The strategic project for this part of the specific objective is the **construction of Line 2 of the Pomeranian Pipeline.***



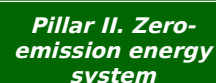
3B. PEP  
STRATEGIC  
PROJECT

\* \* \*

**The crude oil transmission infrastructure** consists of three sections - two sections of the Druzhba pipeline and the Pomeranian Pipeline (approx. 890 km in total). Three lines of the Eastern Section of the Druzhba pipeline enable import of crude oil from the East (56 million tonnes/year) to the refinery in Płock, and then via the Pomeranian Pipeline to the refinery in Gdańsk (27 million tonnes/year). The use of the Pomeranian Pipeline is reversible and therefore it is also possible to transfer crude oil imported by sea (30 million t/year) to Płock. The Western Section of the Druzhba pipeline serves to supply German refineries with crude oil and enables the pumping of crude oil from/to the largest crude oil storage facility in Poland in Góra and the transport of crude oil extracted from Polish fields westwards.



development of  
crude oil  
transmission  
infrastructure



Pillar II. Zero-  
emission energy  
system

The Pomeranian Pipeline - despite its reversible nature - is the weakest link in the oil transmission system. The artery is constructed with only one line, which means that in the event of a failure, there is no alternative transportation route on this strategic section. Moreover, due to the bidirectionality of the pipeline, there is a problem of competition for throughput between refineries in Płock and Gdańsk. At the same time, such a limited throughput makes it impossible to increase the use of raw material imported by sea, via Oil Terminal in Gdańsk. It is the **growing importance of sea supplies of crude oil** that is of key importance to the diversification of supplies to Polish refineries. This is why PERN S.A. has included in its investment plans the **construction of the second line of the Pomeranian Pipeline** by 2023. The validity of this

<sup>62</sup> See also: *Polish Government policy for logistics infrastructure in the petroleum sector, 2017.*

investment was confirmed in 2019 by the occurrence of contamination of crude oil transported via the Druzhba pipeline with organic chlorides harmful to the refinery. Following the temporary suspension of crude oil supplies by land from the East, the refinery in Płock imported the raw material exclusively by sea, making full use of the existing line of the Pomeranian Pipeline. If the second line existed, the contaminated crude oil could be simultaneously pumped northwards in order to clear the transmission system of oil that does not meet quality standards and it would be possible to transfer the oil from the Góra storage facility and PERN S.A. depots in Miszewek Strzałkowski and Adamowo to the refinery in Gdańsk.

Furthermore, the extension of the *Central Europe Pipeline System* (CEPS) on the territory of Poland is also being analysed. Its extension to Poland and other Baltic states may have a positive impact on NATO's eastern wall fuel security.

The fuels produced in refineries as a result of crude oil processing are transported to various parts of Poland by pipeline, rail, and road - depending on availability - by one means or by combined transport. Pipeline transport is the safest and most efficient way, but the profitability of artery construction depends on demand. **The network of product pipelines** (over 935 km) is concentric, enables to transfer fuel from the refinery in Płock to Warsaw, Poznań and Upper and Lower Silesia, i.e. regions with the highest demand.

development of  
liquid fuel  
transmission  
infrastructure

Pillar II. Zero-  
emission energy  
system

However, the line towards Upper Silesia reaches only the vicinity of Częstochowa (Boronów), which forces combined transport on a relatively large scale due to high fuel consumption in this region. In order to use the economic potential and increase the security of fuel supplies in this region, PERN S.A. started the construction of the **additional Boronów-Trzebinia section, constituting an extension of the Płock-Koluszki-Boronów pipeline**. Further development of fuel pipelines will be carried out in accordance with market demand and on market terms.

development of  
crude oil and  
liquid fuel storage

Pillar II. Zero-  
emission energy  
system

The third strategic element in terms of fuel infrastructure is the **storage for crude oil and liquid fuels**. On the one hand the storage facilities are to ensure the continuity of the process of oil pumping (physical availability for 90 days), on the other hand they are to enable storage of commercial and buffer stocks<sup>63</sup>. Finally, the possibility of separating different grades of crude oil is crucial for a real diversification of oil supply. The three entities hold nearly 9 million m<sup>3</sup> of crude storage capacity and 5.6 million m<sup>3</sup> of fuel, fairly evenly distributed across the country.

In order to ensure technical capabilities of diversification of crude oil supply sources (and thus of diversified grades) to domestic refineries, an adequately developed aboveground storage infrastructure is necessary. In 2020, PERN S.A. made two extremely important investments in this area - **the storage capacity of the depot in Górkki Zachodnie (near Gdańsk) was increased** and the **Oil Terminal in Gdańsk was expanded**. This increased the total capacity by 0.6 million m<sup>3</sup>, i.e. to a level of approximately 1.9 million

<sup>63</sup> See: Specific Objective 4, Part C.

m<sup>3</sup>. At present, it is crucial to adjust the storage capacity of petroleum products to the developing market of liquid fuels. In order to ensure efficient distribution of buffer stocks in times of crisis, it is important to ensure that they are allocated close to the main regions characterised by the highest fuel consumption. To this end, PERN S.A. is conducting an investment programme for the construction of 0.222 million m<sup>3</sup> of storage capacity at its fuel depots.

The fuel market is liberalised, therefore in order to provide an appropriate basis for investment decisions, it is extremely important to ensure proper forecasting of the refinery sector's needs. To this end, in 2019, for the first time the Material Reserve Agency (MRA) prepared **forecasts of national demand for storage capacity** for buffer and commercial stocks of fuel and crude oil for a period of 10 years, which will be updated periodically every 2 years.

implementation of  
cyclical  
forecasting of fuel  
needs











*Pillar II. Zero-  
emission energy  
system*




It should be noted that the development of the market for alternative fuels, i.e. the increased use of natural gas in the form of LNG and CNG (compressed natural gas), LPG (liquefied petroleum gas), hydrogen, biomethane, synthetic fuels, or the use of electricity in transport will be accompanied by a slowdown in the growth of demand for crude oil. Bio-components used in liquid fuels and liquid biofuels may also take over a certain share of the market<sup>64</sup>.



Diversification activities are aimed at ensuring security of supply for all consumers in the country, which necessitates the development of internal infrastructure. The development of oil and fuel infrastructure is correlated with the demand for petroleum products and the ability to extend already existing pipelines that run from the main refining hub to major economic centres in the country. In particular, the upgrading and development of infrastructure is to enable access to liquid fuels for large industrial centres to ensure that the economic potential of a given region is used.

<sup>64</sup> See: Specific Objective 4, Part B and Part C - use of bio-components, development of electromobility and alternative fuels.

  <b>Measures</b>	<b>Date</b>	<b>Responsible entities</b>
  3B. Development of crude oil transmission infrastructure - construction of the second line of the Pomeranian Crude Oil Pipeline <div style="border: 1px solid red; border-radius: 5px; padding: 2px; display: inline-block; margin-top: 5px;">3B. PEP STRATEGIC PROJECT </div>	2023	PERN S.A.
  3B. Development of liquid fuel transmission infrastructure - extension of the Płock-Koluszki-Boronów fuel pipeline through the construction of the Boronów-Trzebinia section	2021	PERN S.A.
  3B. Adequate adjustment of increased storage capacities of the Oil Terminal in Gdańsk and the depot in Górki	from 2021	PERN S.A.
 3B. Cyclical (every 2 years) forecast of national demand for storage capacities for buffer and commercial stocks of fuels and crude oil for a period of 10 years.	2021	MRA

 - energy security,
  - economic competitiveness,
  - reduction of the sector's environmental impact

## SPECIFIC OBJECTIVE 4.

# Development of energy markets

The energy sector has undergone significant liberalisation in the last few decades. The development of the energy market makes it possible to offer new and tailored services to consumers and affects the **competitiveness of the economy**. At the same time, partial interference in the market is necessary to ensure **security of energy supply** to all consumers, as well as to meet ambitious **environmental** requirements. Energy is a commodity that determines the functioning of the economy and society, and a lack of monitoring and regulation could, in extreme cases, result in the interruption or cessation of its supply to end consumers, a significant increase in energy prices or a significant burden on the environment.



*Specific Objective 4. The development of energy markets is in line with all three pillars of PEP2040: **JUST TRANSITION, ZERO-EMISSION ENERGY SYSTEM** and **GOOD AIR QUALITY**.*

**Pillar I. Just transition**

**Pillar II. Zero- emission energy system**

**Pillar III. Good air quality**

The energy market, especially in the area of power generation, will develop towards greater involvement of end consumers in the market. Solutions aimed at protecting end users (especially consumers) will be implemented. This will allow the consumers to participate in the transition. The development of energy markets also allows for the emergence of new services that will enable greater integration of renewable energy sources and consequently support the transition of the energy sector towards zero carbon. This is not without an effect on air quality, which will be significantly improved by the electrification of transport and the increased use of alternative and thus low- or zero-emission fuels.

*Below are defined the directions of development of the electricity, natural gas and liquid fuels markets in accordance with the specifics of each market.<sup>65</sup>*

### **PART A) Electricity market development<sup>66</sup>**

The electricity market is considered from the point of view of energy sector entities, self-producers and the consumer's position. The market is transforming due to changes in the environment resulting from the establishment of the European single energy market, increased consumer participation in the market and growing production of electricity from RES.

*The development of the market is influenced by, among other things, strengthening the position of consumers and improving the situation of certain groups of consumers, streamlining of general distribution*

**4A. PEP STRATEGIC PROJECT**

<sup>65</sup> The segment of district heating, due to its specificity correlated with the local demand coverage, is discussed in a separate specific objective - see: Specific Objective 7.

<sup>66</sup> Part A is strongly linked to Specific Objective 2 and the issues and areas of intervention presented should be analysed together.

agreements, demand management, the issue of marketisation of ancillary services, and changes in electricity trading. The PEP strategic project of Part A of this specific objective is the **implementation of the Action Plan for increasing cross-border electricity transmission capacity**.

\* \* \*

Development of the electricity market requires **empowerment and activation of electricity consumers**

This will not only modify the market, but also increase energy efficiency through a more conscious use of energy and the use of local potential. Key tasks in this respect will be carried out through the implementation of the Directive on common rules for the internal electricity market, in particular:

- **widening the information policy** – the consumer should be able to compare offers available on the market and receive comprehensive and clear information within the billing they receive;
- **equipping 80% of households with remote reading meters by 2028** – they are a key element to enable both access to data and information and conscious energy consumption. Their installation is correlated with the construction of a **smart grid**<sup>67</sup>;
- **enabling consumers to take an active role** – the market already has prosumers of renewable energy, energy clusters or cooperatives that take an active **role** (generation, sales, energy storage, DSR), but the scope of activities of active consumers and energy communities<sup>68</sup> will be further clarified. Their activities are the backbone of civic power generation;
- **development and dissemination of aggregation services** – aggregators **will be enabled to operate on equal terms with other entities**. This will make it possible to group the potential of small consumers (who may offer small volumes separately) and provide services to the NPS – e.g. generation or DSR.

**empowerment of  
electricity  
consumers**

*Pillar I. Just transition*

**regulation of  
general distribution  
agreements**

*Pillar I. Just transition*

The issue of **general distribution agreements** (GUD) also needs to be regulated. Currently, the consumer enters into a comprehensive agreement covering distribution and sale of energy (GUD-k), or a separate sales agreement and distribution services agreement. The concluded GUDs allow switching energy sellers, which improves market competitiveness and protects consumers' interests. With a view to simplifying the market and increasing competition, **the obligation to conclude only comprehensive agreements with consumers will be implemented** in 2021. For this reason, trading companies should have appropriate agreements with distribution companies.

<sup>67</sup> See: Specific Objective 2, Part A – development of smart grids.

<sup>68</sup> See Art. 2(11) of the Directive on common rules for the internal electricity market. See also: Specific Objective 6.

Costs related to energy consumption are particularly important for the activities of energy-intensive enterprises (defined as those, where this category in gross added value amounts to at least 3%). Increased costs related to energy consumption affect their competitiveness in global markets, which may cause owners to look for cheaper business locations. This results in loss of capital, changes in the local labour market, and a possible phenomenon of the so-called carbon leakage. Economic development depends on the functioning of modern, large-scale industry, so it is necessary to protect this sub-sector during the transition period. It will primarily mean **taking into account the impact of burdens of individual support mechanisms** (i.e. the support scheme for RES development, high-efficiency co-generation, or the capacity market) on the functioning of **energy-intensive enterprises** by appropriate management of their contribution to covering the costs of these mechanisms.

**protecting the competitiveness of energy-intensive industries**

*Pillar I. Just transition*

**demand management, flattening the daily demand curve**

*Pillar II. Zero-emission energy system*

In order to increase the effectiveness of the operation of the entire national power system, efforts will be made to **flatten the daily power demand curve**<sup>69</sup>, i.e., to reduce the difference between average consumption and peak consumption and to increase demand at night. Demand side management (DSM) through the use of demand side response (DSR) is one way to increase system efficiency. Particularly attractive is the potential of energy-intensive enterprises with a flat electricity consumption profile per day which, in conjunction with their own generation, can provide energy storage services. Currently, companies providing DSR services can benefit from support from, among others, the capacity market, as well as apply for funds for research and development activities. Additional elements that support the objective of increasing the efficiency of power system operations are:

- **the anti-smog tariff**, which on the one hand aims at reducing the problem of low-stack emissions, and on the other hand shifts part of the end user's demand to night periods, when the level of demand for electricity is lower. In the longer term, there will be provided a possibility of **dynamic tariffs**, in which the cost of energy production is reflected in the price of consumption as a function of time. This gives the consumer an incentive to decrease their demand when the price is highest and increase when the price is lower;
- **the development of energy storage technologies**<sup>70</sup> will make it possible to manage electricity supply, especially by RES sources. Storage operators will be able to store energy when the price is low and return it to the grid when the price and demand are high. Electric storage facilities, heat and cold reservoirs at heating plants and CHP plants, as well as gaseous fuels such as hydrogen (in *power-to-gas* plants) or biogas have regulatory potential;
- **the development of electromobility**<sup>71</sup> will increase global electricity consumption, but at the same time electric cars can be used as energy storage, so incentives are

<sup>69</sup> The daily cycle of electricity consumption during the working day is characterised by a higher demand for power during the day than at night and the occurrence of a morning and a pre-evening peak demand.

<sup>70</sup> See: Specific Objective 2, Part B - development of energy storage and recuperation, and development of smart grids, Specific Objective 7 - development of district heating.

being created to charge vehicles at night and feed energy into the grid during peak hours;

- **the development of smart grids**<sup>72</sup> which will enable informed use of energy and efficient management of the grid by the TSOs and DSOs.

Implementation of a smart grid is a step towards building a new, decentralised energy system, where end consumers will be active market participants, services that reward such activity will be developed (DSR, aggregation, dynamic price contracts), and end consumers will strive to self-balance under collective activity, among other things, within self-balancing areas. The new energy market model will be based on distributed energy generation and dispersed consumption not only of end consumers, but also of devices such as electric car charging stations and energy storage facilities. Thanks to wider access to information, it will also be possible for the TSOs and DSOs to manage the power system in a more optimal way.

**marketisation of ancillary services and development of local balancing areas**

***Pillar II. Zero-emission energy system***

The growth of distributed energy sources requires the adaptation of the grid infrastructure to the new market situation. A larger share of RES generation units in the energy mix means a greater need for system balancing and the acquisition of more ancillary services.

The entity responsible for balancing power and energy is the transmission system operator, who contracts ancillary services (e.g. frequency regulation, emergency power reserve regulation, or voltage and reactive power regulation), acquiring them from energy producers. However, due to the development of distributed generation, the role of DSOs in balancing will increase. For this reason, **distribution system operators will be provided with the possibility of creating separate local balancing areas**, where the ongoing balancing of generation and demand takes place. This gives the opportunity to use the advantage of distributed generation, which is the proximity to the place of energy consumption, which contributes to the reduction of energy losses associated with its transmission and distribution. In order to ensure efficient market development in this direction, it is also necessary to develop stronger cooperation between DSOs and the TSOs.

In order to implement this direction, by the end of 2023, a **change will be made in the model of providing** services to the system (marketisation of the ancillary services so far contracted by the TSOs) consisting in enabling the provision of these services by active entities, i.e. generators, aggregators and active consumers. The scope and scale of ancillary services offered by DSOs will be extended, the role and tasks assigned to DSOs will be reviewed and the rules of their cooperation with the TSOs will be amended. This is

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<sup>71</sup> See: Specific Objective 4, Part C – use of bio-components, development of electromobility and alternative fuels.

<sup>72</sup> See: Specific Objective 2, Part B – development of smart grids (PEP2040 strategic project).

particularly important as the first year of supply in the capacity market (2021) will see a significant change in the balancing market – the following mechanisms will cease to function: (a) intervention cold reserve, (b) intervention operation, (c) guaranteed DSR programme, (d) operating reserve. It is worth stressing that changes in the energy market require activity of energy enterprises, which have to adjust their offers and operation models to the new market rules.

In connection with the **establishment of a single European energy market**, as well as **with the obligations resulting from the implementation of the capacity market**, there are significant changes in **electricity trading**. Currently, no bid and offer price limits are applied in the Day-Ahead Market (DAM) and Intraday Market (IDM) other than those prescribed by EU regulations. Also the price limits on the balancing market (BM) are set at a level not lower than that defined for the intraday market. Moreover, an increasing share of trade are cross-border transactions.

**changes in energy trading**




















*Pillar II. Zero-emission energy system*


The implementation of single electricity market solutions will have a positive impact on competition in the electricity market and should lead to equal electricity prices across the EU in the future. Of significant importance are here the new requirements concerning the use of cross-border transmission interconnections introduced by the EU regulation on the internal energy market, which aims at increasing trade between Member States. At the latest by the end of 2025, **transmission system operators are required to make available a minimum of 70% of cross-border capacity** (while respecting the criteria for secure operation of the electricity grid). In order to achieve this objective, Member States must adopt measures to comply with this obligation. This is why in 2019 Poland has prepared and started implementing an **Action Plan** to achieve the indicated objective. The TSOe plays a key role in implementing this action.

 1A. PEP STRATEGIC PROJECT



The territorial approach to the electricity market refers primarily to the participation in the markets of consumers who, depending on their capabilities, can generate and sell energy as well as provide DSR services. Local energy communities influencing the coverage of local needs, as well as aggregators who use the combined potential of small entities are important in this context.

 <b>Measures</b>	<b>Date</b>	<b>Responsible entities</b>
  4A. Empowering electricity consumers by: 1. – extending the information policy for electricity consumers (creating a comparator of energy purchase offers; simplifying information on bills, inclusion of billing information);  – admitting consumers to markets (generation, sales, DSR services);  – developing rules for market access by civic energy communities;  – enabling aggregators to operate on an equal footing with other market players	2021	PURE, energy trading companies, MKiŚ
 4A. Empowerment of electricity consumers - 80% of households equipped with remote reading meters by 2028	2028	distribution companies
 4A. Implementation of the obligation to conclude contracts with consumers exclusively on the basis of GUDs	2021	MKiŚ
 4A. Ensuring protection of the competitiveness of energy-intensive industries	the whole perspective of PEP2040	MRPiT, MKiŚ
  4A. Flattening of the daily power demand curve by: 5 – providing the possibility to use dynamic tariffs, – ensuring conditions for the development of storage technologies, electromobility, smart grids ( <i>tasks in Specific Objective 2B, 4C, 7</i> )	2021	MKiŚ, energy companies, PURE
  4A. Marketisation of ancillary services and increasing the competence of distributors in local balancing	2023	MKiŚ, distribution companies
  4A. Introducing changes in electricity trading (concerning e.g. price limits, intervention mechanisms)	2021	TSOe, MKiŚ, POLPX
  4A. Implementation of the Action Plan for achieving the goal of 70% cross-border transmission capacity by the end of 2025.	2025	TSOe, MKiŚ, PURE
<div style="border: 1px solid red; padding: 2px; display: inline-block;">  4A. PEP STRATEGIC PROJECT  </div>		

 - energy security, sector's environmental impact,

 - economic competitiveness,

 - reduction of the

## PART B) Development of the natural gas market

The development of the natural gas market should be considered in several aspects – from market liberalisation, through the development of the exchange market, to the increase in natural gas consumption and implementation of the idea of a *regional natural gas transmission and trading centre*. The measures are aimed primarily at ensuring conditions for competitive pricing, but also for the use of natural gas in other forms and for other purposes than so far.

*The issues discussed below include liberalisation of the gas market, strengthening of Poland's position in the European natural gas market, and development of new segments of natural gas consumption.*

*The PEP strategic project in Part B of this detailed objective is the **regional natural gas transmission and trading centre (the so-called gas hub)**, which is at the same time an SOR strategic project in the area of intervention: Improvement of national energy security – SP.1(3).*



\* \* \*

In recent years, a number of measures have been taken to foster **competition on the Polish natural gas market**.

In 2013, the obligation to sell 30% of the volume offered to the market via the exchange was introduced, gradually increased from 2015 to reach 55%. Successively developed exchange-based instruments and the above-mentioned exchange obligation have laid the foundation for the creation of a wholesale natural gas market in Poland and made the consumer's right to switch supplier more effective. The trend of increasing competition in the market should continue, both at wholesale and retail market level.

**liberalisation of the natural gas market**

*Pillar II. Zero-emission energy system*

Another important element of the natural gas market liberalisation is the abolition of the obligation of official approval of natural gas prices for individual entities. In 2017, price tariffs were abolished for large companies and all consumers except household consumers. Natural gas prices (turnover) for the last group, i.e. **households, will be released from the tariff obligation at the beginning of 2024**. The completion of deregulation and diversification of supply sources<sup>73</sup> will enable further development of conditions for creating competition, which should result in better terms for consumers.

**Poland's strong position on the European natural gas market - gas hub**

*Pillar II. Zero-emission energy system*  
PROJECT - SOR SP.1(3)

It is of great importance for the functioning of the domestic

<sup>73</sup> See: Specific Objective 3, Part A.

natural gas market to create the conditions for establishing in Poland **a regional centre of natural gas transmission and trade for the countries of Central and Eastern Europe and the Baltic States (gas hub)**. The project primarily requires the construction of the Baltic Pipe, expansion of the LNG terminal in Świnoujście, construction of FSRUs in the Gdańsk Bay area and connections with neighbouring countries, as well as regulatory changes that **will allow to develop the service and commercial offer** by creating attractive market and price conditions to encourage the use of Polish infrastructure. Increasing the volume of natural gas transmitted through the territory of Poland will increase the liquidity of the Polish market and will contribute to lowering the unit rates for services provided by the TSOg, which may allow to reduce the level of charges for end consumers. A number of necessary elements, such as the exchange obligation and the launch of a capacity trading platform, have already been put in place, **but the gas exchange and the exchange trading platform need to be further developed**, where trading on the basis of bilateral agreements will also be possible. The legal, infrastructural and commercial foundation for the creation of *a regional natural gas transmission and trading hub* should be in place by the end of 2022

The expanded infrastructure makes it possible to initiate discussions with neighbouring countries about the potential for **regional integration of natural gas markets**. At the same time, the new conditions of functioning of the natural gas market in Poland must not reduce the security of natural gas supplies to Polish consumers – in the event of supply disruptions on the market, it is necessary to **secure the continuity of supplies to protected consumers**.

#### **The prospect of increasing natural gas consumption**

influences the development of the market of this raw material. It is about both increasing the amount of fuel used and ensuring access to raw material and its use in new sectors. At present, gas is consumed primarily by industry and households and other small-scale consumers (to a much lesser extent by power generation and transport). In particular, the following market developments, for which it is necessary to provide the right conditions, will contribute to increasing the use of natural gas:

**new segments of natural gas use**

**Pillar II. Zero-emission energy system**

- **increasing access to natural gas for domestic consumers through deeper gasification of the country**, and thus eliminating the so-called *white spots* – the DSOs plan to achieve a gasification level in approx. 76% of Polish communes by 2024 (currently 65%), thanks to which approx. 1.5 million more inhabitants, compared to 2018, will have access to the gas network<sup>74</sup>;
- **increasing the use of gas in the form of LNG and CNG** as alternative fuels in maritime and land transport (including inland waterway transport) in Poland and the Baltic Sea Region<sup>75</sup>;
- **increase in the use of natural gas in generation units, including reserve capacity for renewable energy sources and in heat distribution systems and units** – the share of weather-dependent renewable energy is growing, and therefore a flexible reserve capacity is needed, which can be provided by gas sources. At the same time, they provide significantly lower levels of emissions than coal-fired units.

<sup>74</sup> See: Specific Objective 3, Part A – extending the natural gas distribution network.

<sup>75</sup> See: Specific Objective 4, Part C – use of bio-components, development of electromobility and alternative fuels.

**increasing the capacity to transport gases other than natural gas through gas networks**

**Pillar II. Zero-emission energy system**

The energy market is changing, resulting in increased use of low- or zero-emission energy sources. Responding to these needs and in view of the plans to increase the use of **synthetic gases, biogas, biomethane and hydrogen in Europe's gas networks, gas operators** must also engage in **research and development of the possibilities of the introduction of these gases to networks**, their transport and storage. The technical parameters of the existing networks currently allow only a small share of gases other than natural gas in the transport mix, making it difficult to increase the use of these decarbonised gases. This should be done in close cooperation between operators and producers of these gases, so that both the technical parameters of the network and the quality of the gases are taken into account.

Achieving the **capacity to transport a mixture containing approximately 10% of gases other than natural gas through gas networks** (decarbonised gases: biomethane, hydrogen) by 2030 has been indicated as the goal stimulating development in this area.

The current and prospective increase in the use of natural gas for electricity generation as well as the growing importance of decarbonised gases, i.e. synthetic gases, biogas, biomethane, hydrogen, contributes to the coupling of the electricity, gas and the district heating sector. Due to the growing interdependence between these sectors, it is necessary to develop storage technologies, electricity grid and gas network infrastructure as well as gas storage capacity, but also to undertake joint actions by the TSOg and TSOe operators resulting in **the optimisation of the operation of the electricity and gas system** so as to ensure conditions for fully effective cooperation between these sectors.

**coupling of the gas and electricity sectors**




















**Pillar II. Zero-emission energy system**



The territorial gas market should be viewed primarily in terms of ensuring access to natural gas to the largest possible group of consumers in the country. The ongoing activities are aimed at ensuring coverage of the current and potential demand for natural gas and elimination of the so-called *white spots* in access to natural gas, which will be facilitated not only by deeper gasification, but also the use of gas in the form of LNG and CNG.<sup>76</sup>

	<b>Measures</b>	<b>Date</b>	<b>Responsible entities</b>
	4B.1 Liberalisation of the market by abolishing the obligation of official approval of natural gas	2024	MKiŚ

<sup>76</sup> See: Specific Objective 3, Part A.

	prices (tariff obligation) for the last group of consumers, i.e. households from 2024.		
 	4B.2 Ensuring regulatory and transactional conditions for the establishment of a <i>regional hub for natural gas transmission and trade</i>	2023	MKiŚ, TSOg, DSOg, SSOg, POLPX
 	4B.3 Development of the wholesale natural gas market through the development of a service and trading offer in the area of natural gas trading, including gas exchange	2025	MKiŚ, POLPX, TSOg
 	4B.4 Providing opportunities to increase the use of natural gas in new market segments by:	2023	TSOg, DSOg, MKiŚ, MF, gas traders
 	– increasing the degree of gasification in the country;		
 	– dissemination of the use of gas in the form of LNG and CNG ( <i>see Measure 4C.5</i> );		
 	– support for the development and modernisation of the power generation and district heating sectors based on gaseous fuels and the use of gas-fired generation sources as reserve capacity for RES		
 	4B.5 Research and development activities for the transport and storage of synthetic gases, biogas, biomethane and hydrogen through natural gas infrastructure	the whole perspective of PEP2040	TSOg, DSOg, SSOg, research institutes
 	4B.6 Ensuring effective cooperation of the operation of the gas system and the power system ( <i>sector coupling</i> )	2021	TSOg, TSOe
 – energy security,	 – economic competitiveness,		 – reduction of the sector's environmental impact

## **PART C) Market development for petroleum products and alternative fuels, including bio-components and electromobility**

The demand for fuels in Poland will increase in the coming years, although it will be moderate due to a change in the structure of energy demand in the economy. A key element of the change is the increased use of alternative fuels. This will be linked to the transition to a low-emission economy in order to reduce transport emissions, but at the same time it will put enormous pressure on actors in the refining sector. Despite the development of the market for alternative fuels in land and maritime, the use of petroleum-based fuels will continue to be the dominant source of supply for many years to come. It is therefore necessary to ensure appropriate conditions for the functioning and development of this market and the competitiveness of the entities operating on it.

*Issues discussed below include the ownership structure on the fuel market, intervention stocks, market transparency, development of the petrochemicals market, as well as alternative fuels, including electromobility and bio-components, which reduce demand for traditional fuels.*

*The strategic project in this part of the detailed objective is the **electromobility development**, which is at the same time an SOR strategic project in the area of intervention: Technological development - SP.1(1).*



\* \* \*

**regulating the ownership structure of fuel market segments**

**Pillar II. Zero-emission energy system**

The roles of entities in the oil and refinery market must be consistent with their objectives and functions. **Activities of refinery companies in the fuel sector should be focused on fuel production and trade** (core activity) and the storage capacities in their possession should be used for their own purposes. This is important for the competitiveness of the sector and also ensures market predictability and optimal adjustment of investment decisions to the actual needs of fuel production and trade development. Possession of too large a part of storage infrastructure by refining companies hinders forecasting needs in this respect by other entities, which may cause market instability and also impair the fulfilment of state tasks in this area that is so important for energy security. Bearing the above in mind, in order to optimally organise the construction and use of storage capacities, **the leading role in the storage of crude oil and fuels, dealing with the balancing of the entire storage system for crude oil and fuel, will be played by PERN S.A.** whose sole shareholder is the State Treasury. The entity responsible for the implementation of the construction of **new storage caverns** (managing a new rock salt deposit) – due to the need to coordinate the related brine management – **will be the operator of the gas transmission pipelines**<sup>77</sup>.

In order for oil companies to operate effectively, it is also necessary to **optimise** their key activities – **processing and distribution**. The companies must adapt to the

<sup>77</sup> These provisions concern only the fuel market and not the natural gas market. See also: *Polish Government policy for logistics infrastructure in the petroleum sector, 2017.*

environment, which means expanding the retail network, searching for new products and implementing new projects, including alternative fuels (from electricity, through LNG and CNG to hydrogen and synthetic fuels) and services (including bunkering of ships in sea ports). Developing new market segments enables benefiting from a competitive first-mover advantage.

In 2014, the system for creating and maintaining **intervention stocks** of crude oil and liquid fuels has changed. Apart from obligatory reserves maintained by enterprises, a new category of reserves was created, namely *agency reserves* created and maintained by the Material Reserves Agency, and financed by enterprises through a *reserve charge*. For effective intervention on the fuel market, in the event of supply disruptions on the market, it is necessary to **maintain intervention stocks in storage capacities** (in an amount corresponding to at least 90 days multiplied by the average daily net import of crude oil equivalent in the preceding calendar year). At the same time, the different levels of action involve various **intervention procedures**, in line with EU membership and International Energy Agency obligations, but these **will need to be regularly reviewed and updated** in the light of changing market conditions and evolving technologies allowing for more efficient monitoring of the security of supply and more effective market intervention.

**maintenance of intervention stocks**

*Pillar II. Zero-emission energy system*

Ambitious plans for the transition to a low-emission economy, including the decarbonisation of transport, will be a significant challenge for those in the refining sector. It will therefore be crucial for the competitiveness of the economy to **ensure optimum operating conditions for the fuel sector in the interim period** by reducing and simplifying the administrative burden. Tightening the tax system and changing the monitoring system in 2016 contributed to a large reduction in the problem of the grey market in the fuel market. For full transparency of the market, activities aimed at effective monitoring of all fuel market segments will be continued, therefore a **fuel platform** will be established to ensure integration of fuel market data currently collected by various institutions. The platform should be fully functional within 5 years.

**reduction of administrative burdens, market transparency, elimination of the grey market**

*Pillar II. Zero-emission energy system*

It should be noted that the demand for **petroleum** products will also be driven by **an increase in the consumption of petrochemicals**, including those derived from kerosene obtained in the refinery, resulting from greater use in production processes, new applications, e.g. in thermal insulation systems, in construction, the expected increase in the role of plastics and the use of 3D printers. In order to meet growing demand and seize market opportunities, **production capacity will be increased in the areas of olefins, phenol and aromatics**.

**development of petrochemicals market**

*Pillar II. Zero-emission energy system*

In the 2040 perspective, the share of traditional fuels in transport will continue to dominate. Therefore, it is advisable to ensure conditions for the development of technologies allowing to **reduce carbon intensity of production and**

**reducing the carbon intensity of traditional fuels**

*Pillar III. Good air quality*

**consumption of traditional fuels.** Since the markets of EU Member States are not isolated, it is necessary to cooperate at the EU level to ensure comprehensive assessment of the impact of proposed changes on individual industries (including the refining sector) and to develop solutions that are optimal for the European economy and the economies of EU Member States. It is important to ensure support and a level playing field for all promising technologies.

Not only to reduce emissions, but also to reduce dependence on imports, the market will develop towards the **use of fuels other than traditional refinery products** – namely alternative fuels, i.e. electricity, hydrogen, gas in the form of LNG and CNG, liquid biofuels, synthetic fuels used for transport purposes

**use of bio-components and other renewable fuels**

*Pillar III. Good air quality*

The most developed part of the alternative fuels market are **bio-components in liquid fuels and liquid biofuels**. They are of particular importance because they constitute renewable energy sources. In 2018, the share of RES in transport in Poland was 5.6%, in the whole EU – about 8%.<sup>78</sup>

The RED II Directive, adopted in 2018, introduced the obligation to reach **14% share of RES in transport by 2030**, including at least 3.5% from advanced biofuels (from non-food plant matter). Compared to obligations for 2020 resulting from the regulations of the previous RES Directive (RED I), it means a significant increase in demand for bio-components, biomethane and electric energy from RES used in transport. Additional limitations introduced by the RED II Directive, such as the limitation of use of food raw materials (7% and increase by maximum 1% as compared to the level of 2020), increase of requirements concerning the reduction of greenhouse gas emission from biofuel production, as well as the above mentioned target for advanced biofuels, indicate the necessity of transition of that sector in the perspective of the years to come.

It should be noted that increasing the RES share in transport is difficult for many EU Member States, mainly due to: (1) low initial share of electricity from RES in transport, (2) technologically limited possibilities to add first generation bio-components (the so-called blending wall), (3) high prices and low supply of liquid biocarbons (e.g. co-HVO or HVO – hydrated vegetable oil) which may be added to liquid fuels in larger amounts than conventional bio-components, (4) insufficient fuel infrastructure enabling common composition of fuels with bio-components.

In order to achieve the target with regard to the share of RES in transport, the **National Indicative Target (NIT)** is defined for each year, **i.e. the minimum share of renewable fuels and bio-components** in the overall amount of liquid fuels and liquid biofuels consumed during a calendar year in road and rail transport. A detailed breakdown of the achievement of the 2030 target will be defined at a later date, with the development of this market in the longer term being facilitated by:

- striving to maximise the use of conventional bio-components produced from food and fodder raw materials added to liquid fuels (consistent policy of fuel blending E5/E10

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<sup>78</sup> The share of RES in transport in Poland dropped significantly in 2016 as a result of the grey market referred to above.

and B7/B10) to utilise the existing domestic raw material and production potential of methyl esters and bioethanol to the level of the so-called *blending wall*;

- striving to increase the use of waste raw materials to produce bio-components and biogas (biomethane) used in transport;
- seeking alternative solutions aimed at: (1) disseminating available production technologies that are used at too small a scale - e.g. upgrading agricultural biogas to biomethane, co-hydrogenation or hydrogenation of biomass (2) to improve underdeveloped technologies that are at the pilot stage - i.e. advanced biofuels, renewable liquid and gaseous transport fuels of non-biological origin, and recycled carbon fuels.

After 2020, more and more **new technologies of bio-component production** will appear on the market. In order to ensure high fuel quality and transparency of rules applicable to fuel producers and bio-component manufacturers, the processes of coordinating the implementation of new technologies and activities in the area of quality certification and confirming sustainable development criteria should continue to be **coordinated** by the minister responsible for climate issues. Moreover, with a view to limiting potential abuses in the area of correct use of bio-components and other renewable fuels in transport after 2020, **control instruments will be introduced**, such as participation in the establishment of an EU database enabling the tracking of liquid and gaseous transport fuels.

The use of RES in transport is an opportunity to use domestic biomass resources and local potential. From the point of view of raw material competition between the power industry and the agri-food industry and for the purpose of popularising the *circular economy*, it is rational to increase the use of bio-components of waste origin, although the present level of technological development and organisational difficulties hinder their large-scale use. The use of biomethane for transport purposes, produced e.g. from municipal waste and the agri-food industry, is becoming particularly important, and the results of research into increasing the possibilities of transporting gases other than natural gas through gas networks<sup>79</sup> will be crucial to the effectiveness of the application of this technology.

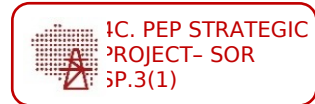
There are also plans to develop the hydrogen market for the transportation sector. Due to the zero-emission nature of hydrogen propulsion, this gas is seen as an attractive fuel for individual vehicles and public transport. The implementation of hydrogen in transport, both in pure form (fuel cells) and as zero-emission synthetic fuels (derived fuels, including N-fuels, using green hydrogen ammonia synthesis), will take place through organised vehicle fleets, including public transport, municipal services and industrial logistics. Not having to charge for several hours is an advantage of hydrogen vehicles over electric ones. In order to enable the development of the hydrogen-mobility, legal regulations allowing the functioning of hydrogen as a fuel will be prepared, and support mechanisms for the development of refuelling infrastructure will be developed.

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<sup>79</sup> See: Specific Objective 4, Part B - increasing the possibility of transporting gases other than natural gas through gas networks.

The second element of the raw material shift in the fuel market is the development of **alternative fuels** other than RES used for transport<sup>80</sup>:

- **electricity (electromobility)** – although the technology of its use in transport is quite underdeveloped and still not very popular, its popularisation is expected to influence not only the fuel market, but also contribute to reducing the problem of low-stack emissions in cities. Support will also be given to the development of energy storage technologies, so important for the electricity market. In order to develop electromobility, it is necessary to build infrastructure, as well as develop demand-side management mechanisms, smart grids, system cyber security and increase the capacity of distribution networks<sup>81</sup> necessary to connect and operate charging points;
- **natural gas in liquefied (LNG) and compressed (CNG) form** – CNG-powered clean vehicles are expected to take a share of the market in a few years, yet smaller than electric vehicles. Popularisation of CNG will require increasing the number of refuelling stations. There is also growing interest in bunkering LNG marine vessels as well as inland waterway vessels. It will also play an important role in ensuring local energy security in areas where pipeline construction is not justified. The use of LNG in the so-called island gas distribution zones will provide access to gas for the district heating sector, but also as a local reserve source for renewable fuels;
- **synthetic fuels** – obtained from natural gas (*gas to liquid*), coal (*coal to liquid*), biomass and also plastics can be used by conventionally powered vehicles without the need to build new infrastructure for them.
- **hydrogen** – hydrogen is currently used in refining, metallurgy and fertiliser production, but demand will increase if it can be transported through the gas network and used in fuel cells to generate electricity. As a result, in addition to existing applications, it could be successfully used not only in the transport sector (cars, trucks, public transport, shipping, aviation, railways), but also in district heating and electricity generation (in fuel cells and gas turbines).



Due to the lack of profitability of the use of hydrogen for energy purposes to date, this technology is at a low level of development. However, due to the physical properties of hydrogen (it is light, reactive, can be stored, has a high energy content per unit mass), its ecological character (the product of its combustion is only water vapour) and the large production capacity of companies in Poland (currently about one million tonnes per year), the issue of using hydrogen for energy purposes becomes a point of increasing interest. It is desirable that hydrogen production should in future be carried

<sup>80</sup> Find more in: *National Policy Framework for the Development of Alternative Fuel Infrastructure*, ME 2017; *Plan for Electromobility Development in Poland*, ME 2017. Liquid biofuels also belong to the category of alternative fuels; however, this part of the market is at a more advanced stage of development. Furthermore, it is a key element in meeting the targets for RES use in transport.

<sup>81</sup> See also: Specific Objective 2, Part B – development of electricity distribution; development of electricity storage and recuperation and smart grids; Specific Objective 4, Part A – flattening the daily demand curve.

out using RES, also as a way of utilising surplus energy production using *power-to-gas* facilities. The use of electrolyzers (P2H/P2G/P2L/P2A/P2X systems) will allow integration of the gas system with the power grid in accordance with the *sector coupling* concept. Apart from "green" hydrogen (coming from RES), during the transition period it is also possible to support hydrogen coming from low-emission sources: biomethane, waste gases, nuclear power, natural gas (also using methane pyrolysis and CCS/CCU technologies).

Popularisation of electromobility and other alternative fuels requires both an adequately developed infrastructure and legal regulations defining the functioning of the market and its stimulation. In 2018, the *Act on electromobility and alternative fuels* was adopted, which established the legal framework for the operation of the market for electromobility and other alternative fuels in transport. The scope of technical regulations and objectives for the development of infrastructure and a catalogue of financial support instruments (e.g. exemptions from excise duty, more favourable depreciation rates) and non-financial support instruments (facilities such as the possibility for electric vehicles to drive on bus lanes, free parking in paid parking zones for electric vehicles) were defined to stimulate the development of this sector. The dynamic **development of these technologies will be regularly reviewed** as part of the annual assessment of the implementation of the objectives set out in the *National Policy Framework for the Development of Alternative Fuel Infrastructure*, which will provide a basis for supplementing the regulations to create adequate support.

Existing regulations are not sufficient for the **use of hydrogen, so a regulatory framework in this area will be developed by the end of 2021** so that the market can fully develop by 2030.

A range of measures are envisaged to support the development of low-emission transport, to be developed in accordance with the ongoing assessment of the adequacy of the level and pace of development. Support can count on both entrepreneurs building the infrastructure for charging electric vehicles and for refuelling alternative fuels, producers of ecological means of transport and local governments investing in clean public transport or entities planning to purchase new zero-emission vehicles.

The following directional goals have been identified for increasing the use of alternative fuels:

- in the area of **electromobility**, 600 thousand electric and hybrid vehicles should be registered in 2030, and in a very ambitious variant, giving an impulse to the development of this sector - as many as 1 million electric vehicles as early as 2025; in order to ensure the possibility of charging, public charging stations should, by 2030, include 49 thousand normal power points and 11 thousand high-power charging stations, and, in a very ambitious variant, 85 thousand and 15 thousand points, respectively<sup>82</sup>;
- in the area of **CNG and LNG**, the target has been set to achieve 54 thousand CNG vehicles in 2025, as well as 70 CNG charging points in 2020, 14 LNG and 32 CNG along the most important roads (the core network of TEN-T, i.e. the Trans-European

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<sup>82</sup> The number of electric vehicles will depend on many factors - technological progress in the development and improvement of electric drives, including changes in the technology of electric battery production, which will reduce the price of electric vehicles. In addition, growing social awareness, ecological trends, greater commitment to the environment may cause potential motor vehicle users to make greater use of urban transport or forms of shared mobility, such as *car-sharing* or *car-pooling*, which may result in a decrease in the number of vehicles purchased. The numbers indicated for charging infrastructure go beyond the *National Policy Framework for the Development of Alternative Fuels Infrastructure*.



















Transport Network) in 2025; and to ensure the possibility of bunkering liquefied natural gas (LNG) in 4 largest ports – Gdańsk, Gdynia, Szczecin and Świnoujście, as well as the possibility of bunkering LNG ships by 2025.






The level of development of the petroleum products market should respond to the ability to meet the demand throughout the country. Apart from organisational issues, an important aspect is to ensure appropriate deployment of fuel infrastructure<sup>83</sup>, including commercial and intervention storage depots, but also the development of branches that will cover part of the demand – from bio-components to alternative fuels and electromobility. These sub-sectors will develop across the whole country, although it should be noted that the production of bio-components has a greater impact on rural areas, while the use of electromobility will have a broader dimension in urban centres.

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<sup>83</sup> See more: Specific Objective 3, Part C.

 <b>Measures</b>	<b>Date</b>	<b>Responsible entities</b>
  4C.1 Ordering of the ownership structure of fuel infrastructure: <ul style="list-style-type: none"> <li>- concentration of refining companies on production and trade in liquid fuels,</li> <li>- assumption of full control over key assets in pipeline transport and storage of crude oil and liquid fuels by the State,</li> <li>- construction of new storage caverns for hydrocarbons and brine management coordinated by the TSOg</li> </ul>	2021	refining companies, PERN S.A., TSOg, MAP, PRSIE
  4C.2 Optimisation of the stock system and increasing the role of the President of MRA in maintaining intervention stocks	2029	MKiŚ
  4C.3 Reducing administrative burdens on the fuel sector and ensuring transparency of the fuel market: <ul style="list-style-type: none"> <li>- reduction of reporting obligations,</li> <li>- establishing and ensuring full functionality of the fuel platform,</li> <li>- improving the rules on the bunkering of maritime vessels</li> </ul>	2023	MKiŚ
  4C.4 Increasing production capacity in the petrochemical area	2030	refining companies
   4C.5 Ensuring conditions for the development of technologies allowing to reduce carbon intensity of production and consumption of traditional fuels	the whole perspective of PEP2040	MKiŚ
   4C.6 Ensuring conditions for the functioning and development of the bio-component and biomethane market to achieve the target of 14% RES in transport in 2030 by striving to: <ul style="list-style-type: none"> <li>- maximise the blending of liquid fuels,</li> <li>- increase the use of waste raw materials to produce bio-components,</li> <li>- search for alternative solutions to previously known and new technologies</li> </ul>	the whole perspective of PEP2040	MKiŚ, companies implementing NIT, other entities
   4C.7 Ensuring operating conditions and support instruments for the alternative fuels market, in particular: <ul style="list-style-type: none"> <li>- <b>electromobility</b>, <span style="border: 1px solid red; padding: 2px;">4C. PEP STRATEGIC PROJECT</span></li> <li>- CNG and LNG,</li> <li>- synthetic fuels in transport,</li> <li>- hydrogen</li> </ul>	the whole perspective of PEP2040	MKiŚ, DSOg, PGNIG S.A., Polskie LNG S.A.

 - energy security, environmental impact\_
  - economic competitiveness,
  - reduction of the sector's

## SPECIFIC OBJECTIVE 5.

# Implementation of nuclear power

There are currently no nuclear power plants in Poland. The nuclear power programme that was implemented in the 1980s (construction of the Żarnowiec and Warta nuclear power plants) was abandoned by a Resolution of the Council of Ministers of 1990. However, in the current situation, the implementation of nuclear power is fully in line with the three elements of the state energy policy objective. Nuclear units, as reliable sources of energy that operate in the base of the power system, have a positive impact on the **stability of energy production with zero emissions of air pollutants**. At the same time, it is possible to **diversify the structure of energy generation at a reasonable cost** – high capital expenditures are compensated by low variable costs of generation in the long term.



*Specific Objective 5. The implementation of nuclear power is in line with two pillars of PEP2040: **JUST TRANSITION** and **ZERO-EMISSION ENERGY SYSTEM**. The use of nuclear power has a number of benefits, including making the following possible in Poland:*

*Pillar I. Just transition*

*Pillar II. Zero-emission energy system*

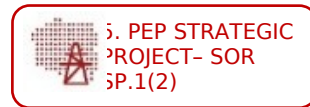
- the implementation of climate and energy policy commitments,
- the reduction of dust and gas emissions from the power generation sector,
- the diversification of supply directions for primary energy carriers,
- the replacement of ageing generation units operating in the system load base,
- reliable and stable energy supply and low costs of electricity for consumers,
- economic boost for regional development,
- the development of many domestic industries (reindustrialisation) and new specialisations and technologies in the whole supply chain of components and products,
- the creation and retention of new, sustainable and well-paid jobs.

The construction of the first nuclear unit should begin no later than 2026, and by 2043 6-9 GW of capacity should be in operation. A detailed schedule and implementation activities are specified in the *Polish Nuclear Power Programme*.

The construction of the nuclear power plant can be carried out **by Polish enterprises up to 70% of the project value**, in cooperation with scientific and research centres. At present, more than 60 Polish companies have experience in nuclear power generation acquired over the last 10 years while performing contracts for foreign nuclear power plants, and about 300 companies have competencies in related industries which, with specific adaptation measures, can be used in the nuclear industry. It is estimated that by 2040 nuclear power will generate about 25-38 thousand new direct jobs, depending on the number of units and installed capacity (6-9 GW). The development of this industry will give an economic boost to the regions and nuclear-related industries. This means new jobs and new specialisations and technology development throughout the component and product supply chain. In addition, the use of nuclear power will significantly reduce emissions of greenhouse gases and dust and gas pollution from the power sector in

Poland. In this way, nuclear power will contribute significantly to the realisation of a zero-emission power system.

*The strategy for introducing nuclear power into the national electricity system is presented below, and the details of implementing this technology in Poland will be presented in the updated version of the "Polish Nuclear Power Programme" of 2014, the consistent implementation of which is a strategic project of PEP2040. PEP2040 strategic project – **Polish Nuclear Power Programme** is at the same time a strategic project of SOR in the area of intervention *Improvement of national energy security* – SP.1(2)*



The main advantages of nuclear power are: zero-emission nature of electricity generation, low costs of energy unit production, diversification of fuel supply directions, ability to maintain a long-term stock affecting cost stability and high life-time of nuclear units. The technologies currently in use (of 3rd and 3rd+ generation) and stringent worldwide nuclear safety and radiological protection standards ensure **the safe operation of the nuclear power plant** and waste storage. More than 50 new projects are underway worldwide. In the discussion on the EU's climate neutrality by 2050, nuclear power is seen as an important part of the power system.

**The first unit** (with a capacity of 1-1.6 GW<sup>84</sup>) **of the first nuclear power plant is scheduled to be commissioned in 2033**. In the following years, **five more units are planned to be commissioned** at intervals of 2-3 years. These time frames result from the power balance in the national power system. Without additional investment in new energy sources, there will be further shortfalls in meeting the increase in power demand at that time due to the wear of existing generating units, especially coal-fired ones. At the same time, it will allow the **reduction of national emissions of greenhouse gases and air pollutants** (both CO<sub>2</sub> and others, e.g. NO<sub>x</sub>, SO<sub>x</sub>, dust) from the energy sector.

In addition to the provision of electricity, a potential zero-emission heat source for industry should also be mentioned, i.e. high temperature reactors (HTRs), which, not being an alternative to large-scale light-water nuclear power units, could be used in the future mainly as a source of process heat. A research project in this field is being carried out at the National Centre for Nuclear Research (NCNR) and is worth continuing. If the project is successful and the HTR technology develops in the world, it will be reasonable to consider using it in Poland for industrial purposes in the long term.

**funding,  
selection of  
technology,  
contractor,  
formal  
improvements**

**Pillar II. Zero-  
emission energy**

<sup>84</sup> In *Conclusions from forecast analyses for "Energy Policy of Poland until 2040"* (Appendix 2 to PEP2040), the unit capacity was assumed to be 1.2 and 1.3 GW. These are mean values for the capacity of nuclear power plants available on the world market, which means that no conclusions should be drawn about the selected technology. Technology selection is one of the implementation tasks foreseen in PEP2040.

In the case of Poland, in order to implement nuclear power, it is necessary to build the infrastructure necessary for development and operation of nuclear power (legal, organisational, institutional, scientific and research facilities, personnel training system, cyber security). Generating the first unit of energy from a nuclear power plant in Poland requires a number of actions. First, **a model for financing the investment will be developed**, followed by the **selection of technology and the general contractor for the project. The choice of location** is determined by the access to cooling water, but also by the possibility of grid connection and decommissioning of other units in various parts of the country. For this reason, the main locations for nuclear power plant construction being considered are first the coast (Lubiatowo-Kopalino and Żarnowiec) and then the central part of Poland (around Bełchatów or Pątnów). A number of changes in legal regulations will also be necessary, as the current regulations do not ensure efficient implementation of this type of investment.

In the long term, there may be an opportunity to use small nuclear reactors in district heating and industry (process heat), so the development of this concept and other new nuclear technologies should be followed. Their possible application will require operational experience from prototype plants to be launched in other countries, which will confirm the reliability and efficiency of this type of reactors.

To implement nuclear power, it is also necessary to provide **adequate human resources**, both for the construction of the plant and its proper operation, and for nuclear supervision. **In terms of estimating staffing needs**, the choice of technology will be crucial, as this will determine the size of the plant's staffing requirements.

**providing human resources for the NPP**

*Pillar I. Just transition*

Another important task is to mobilise the scientific and research potential to provide **technical support tools for the authorities and regulatory institutions** (President of the State Atomic Energy Agency, Office of Technical Inspection). Staffing needs and the pathways and methods for achieving the objectives will be defined in the *Nuclear Human Resources Development Programme* to be implemented by 2030.

**technical enhancement of supervision**

*Pillar I. Just transition*

Spent fuel will be cooled at the plant site for the first few years after removal from the reactor, then safely stored in a storage facility for several decades, before being transported to a deep repository or reprocessing. The *National Plan for Radioactive Waste and Spent Fuel Management* points to the open cycle (disposal) as the preferred method for spent fuel management, while not excluding the possibility of reprocessing (recycling).















Low- and intermediate-level radioactive waste will be disposed of at the national radioactive waste disposal facility. As the current disposal facility will not cover all needs, **a new disposal facility** will be opened for low- and intermediate-level radioactive waste.

According to analyses to date, Poland does not possess industrial quantities of uranium from conventional deposits. Fuel to power the Polish nuclear units will come from imports.

The direction of origin depends on the choice of technology, with the important fact that it is possible to purchase it from various countries with a stable political situation. In the following years, the potential of unconventional uranium deposits (e.g. in ashes, copper mining waste) for energy purposes may be explored.



The construction of nuclear power units and a radioactive waste disposal facility will impact the region in which they are located primarily by increasing the number of jobs – both in the power plant and its surroundings, additional revenues from local taxes, as well as the development of communication and hydrotechnical infrastructure, which will result in the economic attractiveness of the surrounding areas and the improvement of local living conditions.

 <b>Measures</b>	<b>Date</b>	<b>Responsible entities</b>
 Implementation of the Polish Nuclear Power Programme <div style="border: 1px solid red; padding: 2px; display: inline-block; margin-top: 5px;">5. PEP STRATEGIC PROJECT </div>	the whole perspective of PEP2040	MKiŚ, investor
 5.1 Introduction of legal changes limiting delays in the implementation of the NP construction project for non-technical (formal) reasons	2021	MKiŚ
 5.2 Development of a financial and business model for the nuclear programme	2021	MKiŚ
 5.3 Indication of the location for the first nuclear power plant - Kopalino / Żarnowiec (followed by further site selection for another nuclear power plants)	2021 (2028)	MKiŚ, investor
 5.4 Selection of technology and general contractor for the first nuclear power plant	2021/2022	MKiŚ, investor
 5.5 Drawing up and implementation of a <i>Nuclear Human Resources Development Programme</i>	2021	MKiŚ, investor
 5.6 Development of the nuclear supervision service and technical support institutions	2033	MKiŚ
 5.7 Commissioning of the new disposal facility for low- and intermediate-level radioactive waste	2030	MKiŚ
 5.8 Construction and commissioning of nuclear units: – the first nuclear unit; – another five nuclear units (every 2-3 years)	2024-2043 (by 2033) (by 2043)	investor
 - energy security, environmental impact  - economic competitiveness,  - reduction of the sector's		

## SPECIFIC OBJECTIVE 6.

# Development of renewable energy sources

Measures aimed at the development of renewable energy sources serve to **decarbonise the energy sector and** diversify the structure of energy generation, reduce the intensity of fossil fuel use and reduce the country's dependence on fuel imports, which in the long term will improve **energy security**. Despite the fact that the development of most RES technologies still requires support and currently influences the increase in the costs of energy system operation, the use of RES will result in the decrease in the wholesale prices of energy, as well as the reduction of costs accompanying the emission of pollutants, both in relation to charges per unit of energy generated and to environmental and health costs. In the long run, this will **increase the competitiveness of the economy**.



*Specific Objective 6. The development of renewable energy sources fits primarily into Pillar II **ZERO-EMISSION ENERGY SYSTEM**, as complementing the energy mix with RES-based electricity generation units will make it possible to decarbonise the entire power system. Actions in this direction are also part of Pillar I **JUST TRANSITION** through the development of industry around RES and the transition of regions.*

Pillar I. Just transition

Pillar II. Zero-emission energy system

*Below is presented the approach to ensure the safe use of RES divided by sub-sectors, taking into account the problem of balancing the system, as well as ways to support the development of RES. The strategic project of this part of the specific objective is the **implementation of offshore wind energy**. There are also three projects listed in SOR – distributed power generation, the development and use of geothermal potential in Poland and the use of hydroelectric potential.*



\* \* \*

Increasing the share of RES in gross final energy consumption is one of the three priority areas of the EU's climate and energy policy, as well as global policies and actions to combat climate change.

not less than 23% share of RES in gross final energy consumption in 2030

Pillar II. Zero-emission energy system

In 2018, the share of RES in gross final energy consumption in Poland was 11.3% The largest volume of renewable energy is used in heating and cooling, followed by electricity, and the least in transport. The share of production from renewable sources in

these sub-sectors is respectively 14.8% in district heating and cooling, 13% in electricity generation and 5.6% in transport<sup>85</sup>.

The EU-wide target for 2020 is 20% and 32% for 2030<sup>86</sup>. As part of its EU obligations, in 2020 Poland should achieve a share of energy from renewable sources in gross final energy consumption of 15%<sup>87</sup>. It is assumed that the auctions for the purchase of electricity from RES conducted in 2016-2020 and the support for distributed generation under the current mechanisms and programmes will allow to achieve the aforementioned national target and to further develop RES (among others, as a result of RES auctions for 2021).

Taking into account the national potential of renewable resources, competitiveness of RES technologies, technical possibilities of their operation in NPS as well as challenges connected with development of RES in transport and district heating, Poland declares reaching **23% share of RES in gross final energy consumption in 2030** (measured as total consumption in electricity generation, district heating and cooling, and for transport purposes) as a part of participation in the achievement of the EU-wide target for 2030. **In the 2040 perspective, the RES share is estimated to be at least 28.5%.**

**Technological progress** will have a significant impact on the scale of RES utilisation – both in terms of currently known methods of energy production (e.g. increasing the use of wind by wind power plants or solar radiation by photovoltaic panels) and in terms of completely new generation technologies, but also in the area of energy storage. **The RES target will be met by increasing the use of RES in all three sub-sectors**, but the rate of growth of RES use in particular sub-sectors will vary.

The chart below shows the forecast of the growth in renewable energy use in the indicated sub-sectors and the growth path of RES share in gross final energy consumption in the 2040 perspective. The data table next to the legend shows the possible RES share in total and in the sub-sectors. *Detailed forecasts of renewable energy consumption can be found in Chapter 1.9 of Appendix 2 to PEP2040.*

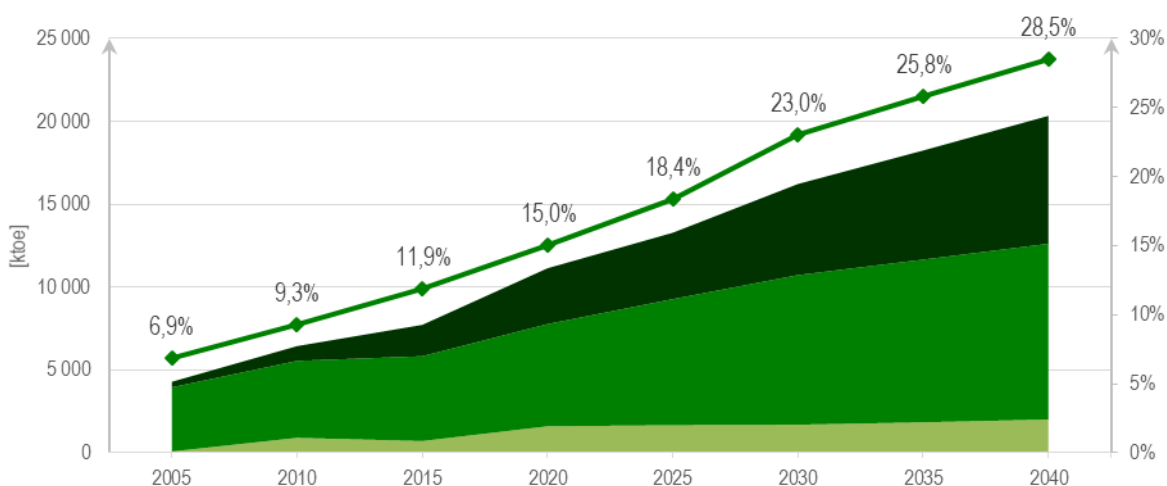
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<sup>85</sup> Between 2010 and 2015, the share of RES in gross final energy consumption in transport was in the range of 6.25-6.85%, but the disclosure of the grey market in 2016 caused a significant decrease in this indicator down to 3.9%, which has an effect also in the following years.

<sup>86</sup> The individual national targets for 2020 are set out in the Appendix to Directive 2009/27/EC on the promotion of energy from renewable sources – according to technical and economic potential. The 2030 target is set for the EU as a whole, but Member States determine their own contributions based on technical potential and economic conditions and taking into account recommendations from the European Commission.

<sup>87</sup> Eurostat data on the 2020 target will be available in Q4 2021.

## Renewable energy consumption forecast for 2020-2040



	2020	2030	2040
<ul style="list-style-type: none"> <li><span style="color: green;">■</span> share of energy from renewable sources in gross final energy consumption</li> <li><span style="color: darkgreen;">■</span> gross final energy consumption from renewable energy sources in the power sector</li> <li><span style="color: mediumseagreen;">■</span> gross final energy consumption from renewable sources in district heating and cooling</li> <li><span style="color: lightgreen;">■</span> gross final energy consumption from renewable sources in transport</li> </ul>	<b>15.0</b> %	<b>23.0</b> %	<b>28.5</b> %
share of energy from RES in gross final energy consumption	22.1%	31.8%	39.7%
share of energy from RES in the power sector	17.4%	28.4%	34.4%
share of RES energy in district heating and cooling	10.0%	14.0%	22.0%
share of RES energy in transport (with multipliers)			

Source: Eurostat data, own study

## use of RES in transport

### *Pillar II. Zero-emission energy system*

EU regulations oblige Poland to achieve a 14% share of renewable energy **in transport**<sup>88</sup> by 2030, including at least 3.5% coming from advanced (non-food) biofuels. Compared to obligations for 2020 resulting from the regulations of the previous RES Directive (RED I), it means a significant increase in demand for bio-components, biomethane and electric energy from RES used in transport. Additional limitations introduced by the RED II Directive, such as the limitation of use of food raw materials (7% and increase by maximum 1% as compared to the level of 2020), increase of requirements concerning the reduction of greenhouse gas emission from biofuel production, as well as the above mentioned target for advanced biofuels, indicate the necessity of transition of that sector in the perspective of the years to come. The following will contribute to meeting these objectives:

- **bio-components added to liquid fuels and liquid biofuels used in transport**, and obtained from food and fodder raw materials (1st generation biofuels) – they will be of key importance for the achievement of the abovementioned target, however, in the long run, not only their role, but also their volume will be decreasing;
- **advanced biofuels** (non-food) and recycled carbon fuels (biofuels of at least 1st generation) – the advantage of their use is limiting competition of raw materials between power industry and agriculture, agri-food industry or processing industry. They will meet demand for a limited supply of 1st generation biofuels, but the total supply and demand for biofuels will remain roughly constant between 2020 and 2040;
- **electricity in transport** – the development of electromobility is expected to increase at a rapid pace. The amount of electricity used for vehicle propulsion that counts towards the RES target in transport depends on the share of RES in electricity. The electrification of transport will bring about huge changes in the transport sector, which is why the **development of electromobility** has been defined in *PEP2040 strategic project* which is described in Specific Objective 4C. It is also an SOR strategic project;
- **biomethane** produced from biogas, especially from agricultural biogas from waste and by-products from agriculture and agri-food processing.

## RES use in district heating and cooling

### *Pillar II. Zero-emission energy system*

Share of RES **in district heating and cooling**<sup>89</sup> will increase by about 1.1 percentage points on average per year in 2020-2030. The use of biomass will play a key role, but significant effects are also expected from the popularisation of heat pumps and photovoltaic panels in households. The goal of increasing the share of RES in heat and cold generation will be implemented using the following sources/technologies:

- **biomass energy** – biomass has the greatest potential to meet the RES target in district heating due to fuel availability and technical and economic installation parameters. It can be used in cogeneration, but also in households, although non-

<sup>88</sup> The use of bio-components and electricity for transport purposes is described in Direction 4, Part C. Development of the market for petroleum products and alternative fuels, including bio-components and electromobility.

<sup>89</sup> The role of RES in heating and cooling is also addressed under Specific Objective 7. Development of district heating and cogeneration.

combustible RES are more preferred<sup>90</sup>. Biomass production units should be located close to the place of its production (rural areas, wood industry basins) to minimise the environmental cost of transport. The energetic use of biomass also contributes to better waste management;

- **heat pumps** - the use of this technology is becoming more and more popular in households, but they can also be successfully used in the operation of heating systems, as well as for building cooling. Their share and importance in covering heat needs from RES will grow. Electricity is needed to use them, so the development of hybrid plants that combine heat pumps and photovoltaic panels should be pursued;
- **solar energy** - processed in solar collectors allows to cover heat needs, while the electricity produced in photovoltaic panels will be particularly useful to cover growing needs for cooling and to cover summer peaks in electricity demand. Due to the inverse correlation between insolation and thermal needs, the increase of solar radiation use for thermal purposes is dependent on the technological development of electricity and thermal energy storage, more efficient use of energy by heat pumps, but also the conversion of heat from solar collectors for cooling purposes.
- **energy from biogas** - the use of biogas will be particularly useful in the cogeneration of electricity, heat and gaseous fuels. Thanks to the possibility of its storage, biogas can be used for regulating purposes and for self-balancing of energy clusters and energy cooperatives. From an economic point of view, biogas offers additional value, as it makes it possible to manage particularly noxious waste (e.g. from agriculture, agro-food industry, animal waste or biodegradable municipal waste). Biogas builds a very important potential for the development of agricultural land;
- **geothermal energy** - although its use is currently at a relatively low level, an upward trend is expected. Determining the geothermal potential requires a lot of money with a high degree of uncertainty, but using this type of source has many advantages related to energy and for the development of local potential. In order to create conditions for promotion and development of renewable energy sector based on geothermal sources, in SOR, in the area of intervention *Technology development* a strategic project was indicated **Development and use of geothermal potential in Poland** - SP.3(2).

SOR  
strategic  
project -  
SP.3(2)

use of RES in the  
power sector

Pillar II. Zero-  
emission energy  
system

The use of RES in electricity generation<sup>91</sup> will systematically increase, especially after 2025, due to the expected technological and economic maturity of individual technologies. **It is estimated that in 2030 the share of RES energy in the power sector will be at least 32% net**, and about 40% in 2040. **Legal conditions and system mechanisms** will support the achievement of this goal and the development of individual technologies, in a way that ensures the safety of grid operation and the acceptability of electricity prices. The use of the following types of RES in the electricity sector will contribute to the increase of the share of the following RES:

- **offshore wind energy** - offshore wind power plants are characterized by productivity higher than those located on land. The ability to receive power from these units is

<sup>90</sup> Although plants absorb CO<sub>2</sub> during the growing season through photosynthesis, burning biomass involves particulate emissions that contribute to the so-called low-stack emissions.

<sup>91</sup> See also: Specific Objective 2.

contingent on the completion of the transmission grid reinforcement in the northern part of the country. It is expected that the first offshore wind farm will be included in the power balance around 2024/2025. In the area of the Polish Exclusive Economic Zone in the Baltic Sea, there is a possibility to implement further wind plants, but the possibility to balance them in the NPS and the development of grid infrastructure are crucial for the investment. It is expected that the installed capacity of these sources in the 2030 perspective may reach 5.9 GW. In 2040, the potential is estimated to be around 11 GW. Production from offshore wind farms will account for the largest share of electricity generated from RES. Due to the strengths of the performance characteristics of this technology, the **implementation of offshore wind energy** has been identified as an *PEP2040 strategic project*, which is described below;

- **solar energy** (photovoltaics) – despite a relatively low use of the installed capacity compared to other RES, the advantage of this technology is a positive correlation between the intensity of sunlight and daily demand for electricity and increased generation in the summer period correlated with the demand for cooling. It is estimated that photovoltaic sources will reach economic and technical maturity after 2022. In 2030, the installed capacity may reach about 5-7 GW in total in micro and large installations and as much as 10-16 GW in 2040. Installing photovoltaic panels is an alternative to using brownfield sites and poor quality land, as well as the roofs of buildings, including private ones. The dynamic development of microgrids<sup>92</sup> is boosted by dedicated financial support programmes, such as "Mój Prąd" or "Energia Plus";
- **onshore wind energy** – the growth of this technology's share in the energy balance is expected to be less dynamic in the medium term compared to previous years. A major impediment to the use of wind power is the lack of correlation between its operation and energy demand, so the rate of its development should depend on costs and balancing possibilities. The construction of wind power plants is also burdened with the risk of lack of social acceptance, therefore in order to limit potential social conflicts, the so-called 10H rule has been introduced<sup>93</sup>, which may be modified in the future. The potential for development of new onshore wind farms as both *brownfield* and *greenfield* investments is also noticeable. Moreover, the widespread use of long-term power purchase agreements (PPA) could contribute to the development of onshore wind energy and lead to making regulations governing these technologies more flexible;
- **biomass and biogas energy** – their potential will be used mainly in the heating sector, but part of the resources will also be directed to electricity generation, especially in cogeneration. The electricity and biomethane produced can also be used for transport. The advantage of biogas is the possibility to use it for regulating purposes, which is particularly important for the flexibility of the NPS operation;
- **hydropower – the use of hydropower potential** is to ensure the development of water resources management, increase the role of retention, inland waterways and revitalisation of water dams, increase the number of water thresholds, which are important from the point of view of watercourse regulation. The implementation of these measures will have an impact on the development of hydropower. It should be noted that the operation of flow power plants can be regulated, however to a limited extent. The energy generated in pumped storage hydroelectric power plants is partially counted as RES,

**SOR**  
**strategic**  
**project –**  
**PEP2040**

<sup>92</sup> At the end of 2017, about 28.8 thousand microgrids with a total capacity of about 183 MW were connected to the five DSOs. According to the URE's data, there were 55 thousand microgrids with a capacity of 353 MW at the end of 2018, and 155,6 thousand microgrids with a total capacity exceeding 1 GW at the end of 2019.

<sup>93</sup> The so-called 10 H rule means that wind turbines cannot be built within ten times the height of the entire plant from the nearest residential building. The rule also includes obtaining a building permit for a residential building within this distance from an existing turbine.

but they perform a regulating function for the NPS. Given the regulating potential of hydropower, it is worth exploring new ways of harnessing it, also on a small scale.

**The use of hydropower potential** is a strategic project of SOR in the area of intervention *Technology development - SP.3(4)*.

### implementation of offshore wind energy

*Pillar I. Just transition*

The RES market is very dynamic, therefore legislation needs to be adjusted on an ongoing basis and provide further conditions for development. The current regulations do not cover the operation of offshore wind energy, which will be one of the main elements of the electricity transition. For this reason, **a legal framework for the operation of this type of power plant has been set out in a separate act in 2020**. The coming into force of the aforementioned Act as of 2021 will allow for the commissioning of the first **offshore wind farm** around 2024/2025 and will provide conditions for further development of electricity generation in offshore wind farms on a competitive basis in a long-term perspective. Extension of the transmission grid in the northern part of the country, as provided for in the TSOe's investment programme, is also of great importance for the implementation of this technology into the NPS. Furthermore, it is also necessary to construct a **main offshore terminal** (seaport) dedicated to service the supply chain of components necessary for the development of offshore wind energy in Poland and to provide logistic support for offshore wind energy on the Baltic Sea.

5. PEP STRATEGIC PROJECT

Apart from the enormous impact on the reduction of emissions of electricity generation, the implementation of offshore wind energy will also contribute to the development of other sectors of the economy related to this technology, giving an economic stimulus to the regions taking advantage of this market opportunity and providing about 63 thousand new jobs.

An important advantage of RES is the ability to use the local potential (including less developed regions and rural areas). The distribution of generating units and their deployment close to consumers allows rational and effective use of the RES potential at the local level, as well as the reduction of losses in the transmission and distribution of electricity, which occur in the case of a large distance between the places of energy generation and the places of consumption.

### distributed power generation

*Pillar II. Zero-emission energy system*

**Distributed power generation**, based on plants with relatively small capacity, is the basis for the development of the local dimension of energy and gives a participatory character to the energy transition. In addition to large business projects, much smaller entities can participate in building a low-emission power system by actively engaging in the energy transition process. **Distributed power generation** is an SOR strategic project in the area of intervention *Technology development - SP.3(2)*.

SOR strategic project - SP.3(3)

Two groups of active entities can be distinguished within distributed power generation, such as:

- **active consumers** - these are mainly individual entities, including among others prosumers of renewable energy, who produce energy for their own needs, but have the possibility to return the surplus of produced electricity to the grid or sell it, store energy and participate in other forms of activity (e.g. DSR, energy efficiency). Active consumers form the backbone of civic power generation. The target for 2030 assumes increasing the number of renewable energy prosumers to 1 million;
- **energy communities** - these are mainly collective entities, such as energy clusters, energy cooperatives and other entities that organise themselves in order to generate electricity for their own needs and undertake other activities (e.g. storage, energy sharing, etc.) for the benefit of their community members. A target has been set for 2030 to increase the number of such collective entities to 300.

Entities operating in the field of distributed generation remain connected to the distribution grid, therefore, **it is necessary to regulate the area at the interface of their activity** and the activity of DSOs. The target model could be for these entities to strive for independence from electricity supply from the national grid and self-balancing. The development of energy storage and DSR technologies will be key in this regard. However, at the transitional stage, when energy communities benefit from connection to the distribution grid, it is necessary to regulate the extent to which they will participate in grid costs in order to, on the one hand, properly reflect their impact on the power grid and their contribution to the development of local energy security and, on the other hand, encourage these communities to become active, e.g. through certain reductions in grid charges.

Failure to adapt RES development to the **reception and balancing capabilities of the NPS** may have a negative impact on energy security. A significant part of the renewable energy generation capacity installed in Poland is based on sources whose operation profile is dependent on weather conditions (wind, sun, partly water) and which operate a small number of hours per year. This results in the need for reserve capacity and increased flexibility, which affects the overall cost of power generation. This applies to both large-scale RES plants and small-scale distributed energy plants.

**RES balancing - storage, regulating sources**  
**Pillar II. Zero-emission energy system**

For this reason, grid infrastructure will be expanded and energy storage will be developed. Gradual replacement of the passive grid (one-way) with an active network (two-way) and smart energy management systems, or creation of incentives to improve the price elasticity of energy demand (DSR), as well as popularisation of aggregators and active consumers will contribute to the growing importance of local energy.<sup>94</sup>

In the longer term, the **connection of a non-controllable energy source** should be linked to the obligation to **provide balancing power** during periods when the RES does not supply electricity to the grid. Potential solutions could include building a storage facility or balancing source based on e.g. controllable RES.

**support for RES development**  
**Pillar II. Zero-emission energy system**

<sup>94</sup> See: Specific Objective 2 and 3, Part A.

**The mechanisms for support and promotion** of RES energy generation, as well as the time frame of the support, will be adjusted to market needs, correlated with ensuring system operation security conditions. Preference will be given to the following solutions:

- ensuring **maximum availability** (high efficiency and utilisation factor, controllability, **use of energy storage**), with relatively lowest cost of energy production, as well as using hybrid solutions combining various RES technologies or self-balancing RES, e.g. with the use of energy storage;
- meeting **local energy needs** (heat, electricity), increasing the use of RES in transport, but also related to waste management (consistent with the waste hierarchy) and the use of local potential.

Support will depend on the type of source and its size, which can be divided into the following forms:











- **priority access to the grid** - currently applies to all RES plants and is an important element of support; in the future, after fulfilling the necessary conditions set out in the EU Market Regulation, it is possible to abandon this form of support;
- **auctions** - are intended for large-scale sources, and the choice of supported areas depends on the preference to stimulate the development of RES areas, based on economic, environmental and climate conditions, while respecting energy security;
- **Feed-in Tariffs and Feed-in Premium guaranteed tariff system** - aimed at relatively small capacity plants, serves the purpose of systemic management of energy not used by a small generator;
- **grants, repayable aid** - a mechanism depending on local needs, distributed particularly in the regions;
- **guarantees of origin** - a document confirming to the end consumer that a specific amount of electricity, which has been introduced to the grid, has been produced from RES - they have the form of a certificate, and demand for them is created by consumers who want to emphasise the environmental image of their company;
- **aid mechanisms targeted at specific technologies** - this solution is intended for sources which have no competition on the market, as they are a new technology (e.g. offshore wind energy), but for various reasons their implementation on the market is important for the country - e.g. high annual capacity utilisation.

The latest climate and energy trends, increasing social awareness, corporate social responsibility and growing product competition have all contributed to an increasing number of companies aiming to switch completely to green energy. Long-term contracts for purchase of energy from RES - PPA and cPPA (corporate power purchase agreement) are becoming more and more popular market instruments supporting development of RES, allowing both parties of the contract, generators and entrepreneurs, to benefit. A PPA is an agreement whereby a natural or legal person agrees to purchase renewable electricity directly from an electricity producer at a predetermined price. This instrument allows consumers to protect themselves against energy price fluctuations and generators to obtain financing for investments at the assumed level. Further development of PPA will successfully complement the existing RES support schemes.



Renewable energy generation, due to its dispersion, causes significant, usually positive, territorial impacts. Installations are often owned by small-scale

generators (individual or industrial) and the substrate (biomass) used in some technologies also comes from relatively small-scale sources. The development of energy clusters and cooperatives will have an even greater impact on the growing involvement of local actors. It also has a positive impact on the overall development of the region - from infrastructure, to deepening ties within local communities and increasing environmental awareness.

	Measures	Date	Responsible entities
	6.1. Ensuring conditions for achieving at least 23% share of RES in gross final energy consumption in 2030, including: <ul style="list-style-type: none"> <li>– <b>in the heating and cooling sector</b> - an annual increase in the share of RES by 1.1 percentage points on average per year,</li> <li>– <b>in the power sector</b> - an increase in the share of RES in electricity generation to at least 32%,</li> <li>– <b>in transport</b> - achieving a 14% share of RES in 2030, including an increased use of advanced biofuels and electromobility <i>(tasks also implemented under Specific Objectives 2, 4C and 7)</i></li> </ul>	2030	MKiŚ and other entities
	6.2. Ensuring conditions for the implementation of offshore wind energy, including the definition of a legal framework for its operation and the expansion of the transmission grid <div style="border: 1px solid red; padding: 2px; display: inline-block; margin-top: 5px;">             6. PEP STRATEGIC PROJECT  </div>	2025	MKiŚ, TSOe
	6.3. Ensuring conditions for the development of distributed power generation – renewable energy prosumers, energy clusters, energy cooperatives	the whole perspective of PEP2040	MKiŚ, MRPiT, local governments, other entities
	6.4. Ensuring conditions for balancing renewable sources	the whole perspective of PEP2040	MKiŚ
	6.5. Ensuring financial support for RES and improving its existing forms, taking into account the role of technology in the NPS	the whole perspective of PEP2040 or until economic maturity is reached	MKiŚ, NFOŚiGW, WFOŚiGW, other entities
 - energy security, environmental impact_	 - economic competitiveness,	 - reduction of the sector's	

## SPECIFIC OBJECTIVE 7.

# Development of district heating and cogeneration

Energy consumption for heating and cooling accounts for the highest volume of energy use of the three energy sectors, with households accounting for over 80% of primary energy use. Therefore, meeting the demand for heat is an important element of **energy security**. Actions in this area are aimed at the **efficient use of primary energy** for space and water heating, as well as reduction of energy poverty. They contribute to the **reduction of pollution** both in the large-scale and industrial energy sector, which is obliged to comply with restrictive emission standards, and in households. The savings and benefits to be gained from implementing low-emission heating solutions will **benefit the whole economy** in the long term. The expenses incurred will be compensated not only by lower heat consumption costs at the end user level, but also by improved air quality, improved thermal comfort and reduced health costs.



*Pillar I. Just transition*

*Pillar II. Zero- emission energy system*

*Pillar III. Good air quality*

*Specific Objective 7. The development of heat engineering and cogeneration is primarily part of the **ZERO-EMISSION ENERGY SYSTEM** pillar, as it is the heat sector's contribution to the decarbonisation of the power system as a whole. It is in line with the **GOOD AIR QUALITY** pillar, as it contains a number of tasks which will reduce low-stack emissions in the area of individual heating (e.g. in the field of replacement of individual heating sources, education and change of public habits). At the same time, it will allow to extend additional support to end consumers affected by energy poverty, which will significantly contribute to the implementation of **JUST TRANSITION**. The role of local energy planning and the creation of a heat map<sup>95</sup> are also important in this regard, as a way of embracing the transition of economically disadvantaged regions.*

 **7. PEP STRATEGIC PROJECT**

*Below are presented the objectives and measures for meeting the heat demand of the economy broken down into district heating and individual heating systems. The strategic project of this specific objective is the **development of district heating**.*

\* \* \*

**energy planning at local level**

<sup>95</sup> Prepared in connection with Art. 14 of the revised Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency.

**Pillar I. Just transition**

The involvement of local authorities and local energy planning has a special role in the implementation of the state policy on district heating. Heat needs are met close to the place of residence and heat markets are local in nature. In 2018, only 22%<sup>96</sup> of communes had a planning document for the supply of heat, electricity and gas fuels. Therefore, it is necessary to **increase the activity of communes, poviats and voivodeships in the field of local energy planning**, the aim of which is the rational use of energy resources, maximisation of the effective use of the existing energy infrastructure, development of low-emission energy sources and improvement of air quality. Planning should be based on real cooperation between local government units, taking advantage of local synergies and potential.

A useful tool for energy planning will be a **data collection system for a nationwide heat map**. Access to such data will allow regions, communes and enterprises to estimate the potential for development of district heating networks and cogeneration in their area, and will provide new investors with information about the existing infrastructure. This action is planned to be implemented from 2021 onwards, although the development and extension of this tool may be extended to subsequent years because of the complexity of the issue.

**preparation of a nationwide heat map**

**Pillar I. Just transition**

**increasing the share of RES in heat production**

**Pillar II. Zero-emission energy system**

Due to the need to develop low-emission district heating, improve air quality and implement the REDII Directive, **the share of RES in heating and cooling will increase by 1.1 percentage points on average per year<sup>97</sup> in 2020-2030**. Steps aimed at making heating sector green will be carried out in district heating (both in efficient and inefficient systems) and in individual heating. The actions carried out will be of hybrid character and each of the above mentioned sectors must participate in achieving the RES development objective.

**Covering heat needs** should be done primarily through the use of **district heating**, wherever possible. Such a model ensures the high efficiency of raw material use, improves the living comfort of citizens and reduces the problem of the so-called low-stack emissions<sup>98</sup>. Thanks to widespread pro-efficiency measures, the total demand for heat is decreasing, but the number of district heating consumers should be increasing. If a connection to the district heating network is not possible, it is necessary to use individual sources with the lowest possible emissions. A target has been set that **by 2040 the heat needs of all households, as well as industry, services, commercial and office**

<sup>96</sup> On the basis of information obtained from Marshal Offices by MKiŚ.

<sup>97</sup> The issue of renewable energy sources is addressed in a separate direction - see: Specific Objective 6.

<sup>98</sup> See also: Specific Objective 6.

**buildings should be met by district heating and by zero- or low-emission heat sources.** The heat needs of other sectors of the economy should also be met in an efficient and low-emission way. Using ecological sources and feeding waste heat into the network has a positive impact on the image of industrial and service companies, but also on their competitiveness. The use of local renewable energy sources in agriculture allows to use the potential of rural areas, while the popularisation of low-emission sources in the public sector has an additional educational function.

The efficiency of district heat supply is determined by the source and supply system. According to EU and national regulations, a **system is energy efficient** if it uses for the heat and cold production at least:

- 75% heat from cogeneration (CHP, combined heat and power) or
- 50% waste heat (by-product of industrial processes) or
- 50% energy from RES or
- 50% uses the combination of energy and heat indicated above.

Currently, only about 20% of the district heating or cooling systems that supply about 85% of the total volume of district heat in the country meet the criterion of an energy-efficient system. In 2018, cogeneration produced about 17% of electricity and about 63.5% of district heat.

### development of district heating

#### Pillar II. Zero-emission energy system

Development of district heating is a strategic project of PEP, which will be implemented through the improvement of the effectiveness of the heating sector, and first of all through the construction and conversion of the existing systems into **energy efficient district heating systems**, which means greater use of low-emission energy sources. The target **for 2030 is meeting the criteria of an energy-efficient district heating system by at least 85% of heating or cooling systems with a contracted capacity exceeding 5 MW.** In addition to the ecological turn, it is also an opportunity to stimulate local economic potential.



The following activities will play a key role in achieving the goal of this PEP strategic project:

- **development of cogeneration**, i.e. simultaneous generation of electricity and heat, which is the most efficient way to use the chemical energy of the primary fuel. The cost of such an installation may be higher than in the case of the construction of a heating plant, but this should be compensated by the revenues from the sale of two types of energy. To encourage the development and use of CHP, **support will be maintained for electricity generated in high-efficiency cogeneration.** The system is expected to remain active as long as the market requires intervention. In the long term, district heat should be produced primarily from CHP and low-emission sources;
- **increasing the use of RES in district heating** – will take place mainly through the use of local renewable energy resources, i.e. biomass, biogas and geothermal energy, as well as solar energy;
- **increasing the use of heat generated in waste-to-energy plants in district heating**<sup>99</sup> (mainly in CHP) – unlike household furnaces, waste incineration plants are

<sup>99</sup> See also: Specific Objective 1 - meeting biomass demand.

equipped with highly efficient flue gas treatment systems and very high temperatures ensure burning out most of the volatile parts. While respecting the EU waste management hierarchy, the thermal treatment of waste fits into the idea of a *circular economy*;

- **power plant district heating and use of waste heat** – for the highest possible energy efficiency, the economic justification and technical possibilities of systematic management of heat accompanying the generation of electricity in power plants or constituting waste from industrial processes should be analysed at the local level. Utilising the potential of industrial entities (self-producers) actively involved in the transition can support and complement utility power projects. As local markets develop, the potential of these ventures will increase;
- **modernisation and expansion of the heat and cold distribution system** – to reduce losses, heat should be transported in pre-insulated networks; care should be taken to intensify modernisation of the existing transmission infrastructure, which is characterized by poor thermal insulation. To increase the coverage of district heating networks, it is also necessary to simplify the investment process for their construction;

Based on the sorption technologies<sup>100</sup> (adsorption and absorption technologies), district heating can also be used for cooling purposes, which is particularly important in summer, as it makes it possible to reduce the demand for electric power and to use the potential of heat sources to a greater extent;

- **popularisation of heat storage** – the use of heat storage enables the heat generated in demand off-peak periods to be stored and then used at times of increased demand, which improves the operation of district heating systems. This solution also allows for the use of surplus electricity generated by non-controllable RES, i.e. wind power plants, photovoltaic panels, or by other innovative technologies to heat the heating medium;
- **popularisation of smart grids** – modern methods of grid management combined with highly efficient sources, pre-insulated grids and heat accumulators allow for optimal heat management, reduction of heat transmission losses, fault detection and streamlining of maintenance operations.

All these **activities will require** financial and organisational **support**, but also proper adjustment of the law. It is equally important to educate the public on efficient and environmentally friendly ways to cover heat needs.

increasing the use  
of district heating

Pillar III. Good air  
quality

**Recipients should primarily use district heating**, so in 2019 the obligation to connect all buildings to the district heating system was extended, if the technical and economic conditions for the connection exist<sup>101</sup>, and the fulfilment of this obligation is verified in the process of applying for a building permit. For this reason, investment support for individual heat sources should be granted only if there is no possibility of connecting the consumer to the district heating network. In 2018, 58% of households in

<sup>100</sup> A heat-powered sorption device can produce cold to replace conventional electricity-powered compressor devices.

<sup>101</sup> The obligation is implemented under the condition that the building will not be equipped with an individual heat source characterised by a non-renewable primary energy input factor no higher than 0.8, or with a heat pump or electric heating, or when heat prices exceed the average selling price for the fuel.

urban areas were connected to the district heating network<sup>102</sup> – the goal is to gradually increase this rate. The target was to reach **70% of households connected to the district heating network in municipalities in 2030**, which means about 1.5 million more households supplied by district heating compared to 2018.

A significant barrier to efficient development of district heating is still the process of construction of heating networks and connections in areas with diversified ownership status. Therefore, by 2021, **regulations to simplify the procedure of obtaining access to third-party land** will be implemented, which will make it possible to efficiently carry out investments in linear heating infrastructure.

Implementation of the tasks (described above) aimed at the development of district heating will contribute to increasing the use of district heat. It is important that district heating prices are attractive to consumers and that they ensure an adequate rate of return for district heating companies. Therefore, it is necessary to **change the heat market model and tariff policy** and **to look for other incentives to optimise heat supply costs and increase the number of actions taken to improve efficiency**.

If it is not possible to connect the area to the district heating network, the heating needs should be **covered by individual sources with the lowest possible emissions**, in particular:

- non-combustible RES plants (including heat pumps),
- electric heating,
- gas-fired plants,
- plants using smokeless fuels.

**low-emission individual sources**  
*Pillar III. Good air quality*

Various forms of financial support from public funds and preferential commercial instruments are an incentive to use ecological heat sources. Local governments and bottom-up local initiatives have a huge role in building environmental awareness and need.

**monitoring of emissions from individual plants**  
*Pillar III. Good air quality*

In many cases, despite the knowledge about the negative effects of burning waste in household systems, it is still used as fuel. Coal fuel quality standards have been established, but improper operation of coal-fired systems, including the method of igniting and feeding, as well as non-compliance with the obligation or improper cleaning of chimneys, affecting incomplete burning of fuel and emission of volatile parts, remain a problem. In order to improve the air quality, **measures related to monitoring of emissions in single-family houses will be intensified** in order to properly address the most urgent **information and education activities**<sup>103</sup>. The Central Building Emissions Register (CBER), on which work has already started, may also prove useful in reducing this problem. It will make it possible to make an inventory of heat sources, fuel combustion sources up to 1 MW, but also electricity sources in buildings.

**reducing the use of**

<sup>102</sup> *Energy consumption in households in 2018*, GUS 2019.





<sup>103</sup> Measures concerning the emission of pollutants have been specified in the *2030 National Environmental Policy*.

In order to reduce one of the main factors of low-stack emissions, but also for the rational use of raw materials (low efficiency of coal combustion in household systems), the use of **solid fuels in individual households** will be gradually reduced. The launched nationwide "Czyste powietrze" support program provides opportunities for replacement of old heat sources and insulation of residential buildings. The size of the grant is based on income, which favours applicants from less affluent households<sup>104</sup>. This will reduce energy poverty and ensure that the energy transition is just.

Bearing in mind the necessity of elimination of the so-called low emission of pollutants, for the sake of health and life quality of the society, the use of solid fuels in individual heating will be gradually reduced. The above will entail abandoning **coal combustion in urban households by 2030, and in rural areas by 2040**. However, until 2040 – also in cities – the possibility of using smokeless fuel will be retained, as long as it does not contradict the so-called anti-smog resolutions.














Meeting thermal needs is done at the local level, therefore energy planning at the commune level and its coherence with the state energy policy is very important. The use of district heating should be pursued, and individual, low-emission heat sources should be used only in areas with a low degree of urbanisation. Monitoring and drawing consequences for excessive emissions should also take place at the local level.

 <b>Measures</b>	<b>Date</b>	<b>Responsible entities</b>
 <ol style="list-style-type: none"> <li>7. Activation of regions in the field of energy</li> <li>1. planning through the amendment of the obligation to execute planning documents for the supply of heat, electricity and gas fuels</li> </ol>	2022	MKiŚ, MFiPR, MSWiA
 <ol style="list-style-type: none"> <li>7. Preparation of a data collection system for the</li> <li>2. heat map</li> </ol>	from 2021	GUS, EC, URE
 <ol style="list-style-type: none"> <li>7. Ensuring conditions for the development of</li> <li>3. ecological and efficient district heating systems through financial, organisational and legal support:                             <ul style="list-style-type: none"> <li>– increasing the use of high-efficiency cogeneration (support scheme)</li> <li>– increasing the use of RES and waste in district heating;</li> <li>– conversion of power plants to CHP plants;</li> <li>– upgrading and expansion of district heating systems and development of technologies for producing cold from district heating;</li> <li>– popularisation of heat storage and smart grids</li> </ul> </li> </ol>	the whole perspective of PEP2040	MKiŚ, MRPiT, PURE, local governments, companies, NFOŚiGW, WFOŚiGW and other entities, depending on adopted solutions

**7. PEP STRATEGIC PROJECT**

<sup>104</sup> Low-stack emission and fuel poverty issues are described in Specific Objective 8.

  	<p>7. Ensuring conditions for increased use of district heating, in particular by:</p> <p>4. – simplifying procedures in the area of conducting investments in district heating infrastructure;</p> <p>– changing the heat market model and tariff policy</p>	2021	MKiŚ, MR, NFOŚiGW
  	<p>7. Creating incentives for the use of non-solid fuels in individual heating – <i>natural gas, non-flammable RES, electricity</i></p>	the whole perspective of PEP2040	NFOŚiGW, local governments, MKiŚ
	<p>7. Increasing the monitoring of emissions in single- and multi-family houses</p>	the whole perspective of PEP2040	MKiŚ, IOŚ-PIB
  	<p>7. Ensuring conditions for shifting away from coal use in households – by 2030 in urban areas and by 2040 in rural areas</p>	2030 / 2040	MKiŚ, local governments

 – energy security, environmental impact

 – economic competitiveness,

 – reduction of the sector's

## SPECIFIC OBJECTIVE 8.

# Improvement of energy efficiency

Improving energy efficiency is a multi-area action with positive effects on all sectors of the economy and society. It indirectly affects **energy security** due to the reduction of fuel and energy demand and the import of raw materials. Pro-efficiency measures allow for energy savings as well as more flexible energy use. This has a direct effect of **minimising the environmental impact of the energy sector** by reducing emissions of pollutants and greenhouse gases, reducing the use of national resources, reducing waste and reusing it in a circular cycle. All of these effects will be achieved while economic development continues unhindered. Energy efficiency measures for buildings, products, appliances, installations and processes reduce energy costs. They are related to the implementation of new technologies and increasing innovativeness of the economy, boosting its **competitiveness**, measured e.g. by the energy intensity of GDP – decreasing energy intensity indicates faster GDP growth in comparison with the growth rate of energy consumption.



**Increasing energy efficiency should be taken into account in the implementation of all actions indicated in PEP2040 specific objectives.** The improvement of energy efficiency has a horizontal character and concerns a wide range of investments in all sectors of the economy.

*Specific Objective 8. Improving the energy efficiency of the economy* falls under two pillars. The first one is **JUST TRANSITION**, as in the area of energy efficiency, the importance of individual bottom-up actions that make up the participatory character of the energy transition is most visible. Every consumer of electricity, heat and raw materials (whether in a household, a company, a local authority or a community) can take pro-efficiency actions. Moreover, improving energy efficiency brings benefits in a wider perspective than energy itself, e.g. by improving human health and living comfort by, among others, combating low-stack emissions caused by the use of poor quality fuels to heat residential buildings. Therefore, it is also an activity in the field of ensuring **GOOD AIR QUALITY**.

**Pillar I. Just transition**

**Pillar III. Good air quality**

*The following are directions of support for the energy efficiency of the economy, as well as answers to related problems, i.e. energy poverty and low-stack emissions. The strategic project of this specific objective is **promoting energy efficiency improvement**.*

\* \* \*

Energy efficiency is one of the three priority areas of the EU climate and energy policy, which in the perspective of 2020 has committed itself to increase energy efficiency by

reducing the consumption of primary energy by 20% compared to the forecasts of 2007.<sup>105</sup> The Polish contribution to the implementation of the objective is to reduce the consumption of primary energy in the years 2010-2020 by 13.6 Mtoe<sup>106</sup>, which in comparison to the forecast values for 2020 from 2007 means a reduction in primary energy consumption by 12.4%. In recent years, Poland has made great progress in saving energy consumption. The intermediate target for 2016 – understood as the achievement of savings in final energy consumption in the amount of no less than 9% of the average national consumption of this energy from 2001-2005 – has been more than achieved, and in the last three decades the energy intensity of the national economy has been reduced by about 30%<sup>107</sup>.

As regards the 2030 climate and energy targets, the EU has maintained its priority on energy efficiency, committing to 32.5% EU-wide energy savings (indicative target) over forecasts, with varying contributions from Member States.

**23% reduction in primary energy consumption vs. 2030 forecasts**

*Pillar I. Just transition*

On the basis of the analysis of effects and impact on GDP and savings potential, Poland declares a **national target for energy efficiency improvement by 2030 at the level of 23% with respect to primary energy consumption forecasts developed by the European Commission in 2007** (118.6 Mtoe), which corresponds to primary energy consumption of 91.3 Mtoe in 2030. At the same time, in accordance with the Energy Efficiency Directive, in each year of the 2021-2030 period Poland will achieve new **savings of at least 0.8% of annual final energy consumption**, averaged over the last three years before 1 January 2019 (average of 69,741 ktoe). *Detailed calculations can be found in Appendix 2 to PEP2040.*

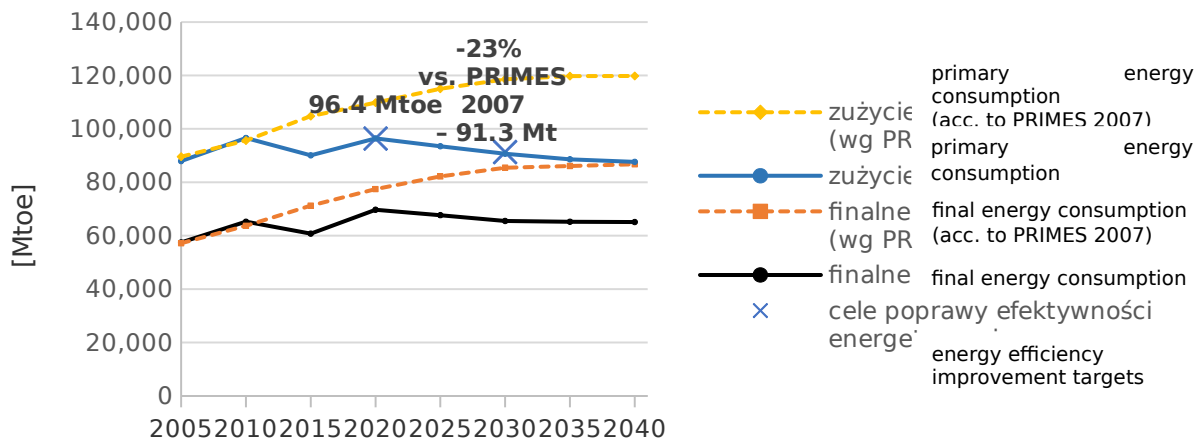
The chart below shows the projected primary energy consumption and final energy consumption as a result of PEP2040 implementation, energy efficiency improvement targets for 2020 (numerical) and for 2030. (percentage of savings over forecasts, corresponding to 91.3 Mtoe) against the background of the European Commission PRIMES forecasts of 2007. *A wider range of forecasts in this area can be found in Appendix 2 to PEP2040.*

### **Forecast of primary energy consumption and final energy consumption in 2020-2040 [ktoe]**

<sup>105</sup> Each Member State shall set a national indicative energy efficiency target based on its primary or final energy consumption, primary or final energy savings or energy intensity. Targets shall also be set in terms of absolute levels of primary and final energy consumption in 2020. Final energy consumption shall be determined on the basis of conversion factors.

<sup>106</sup> In the forecast made for the European Commission (PRIMES – Baseline 2007), which is the benchmark, Poland's primary energy consumption was projected at 110 Mtoe in 2020. Taking the reduction of energy consumption by 13.6 Mtoe into account, the result was 96.4 Mtoe.

<sup>107</sup> Eurostat data.



Source: own study by the Ministry of Climate on the basis of forecasts from Appendix 2

**The potential for improving energy efficiency lies in the entire economy.** The economic sectors are listed below, indicating areas where coordinated action could bring significant benefits:

- **energy sector - generation, transmission and distribution of electricity and heat, gas and fuel sector** - improvement of the efficiency of existing conventional sources; improvement of transmission and distribution efficiency; storage; use of intelligent solutions (including those aimed at activating DSR); increase in production from dispersed energy sources; increase in grid output of RES;
- **households** - thermal modernisation of buildings (insulation of building partitions, replacement, modernisation of central heating / hot water systems), heat recovery from ventilation (recuperation), smart energy management and application of energy-efficient lighting and household appliances;
- **services** - thermal modernisation of buildings (comprehensive thermal modernisation and subsequent introduction of recuperation), modernisation of light fittings or light sources, smart energy management, replacement of IT equipment, lighting of squares and streets;
- **industry** - improvement of energy-intensive processes in production (e.g. steel, paper and cement) e.g. by introducing systems for smart energy use in production processes;
- **transport** - popularisation of alternative fuels and electromobility (electric drive systems have nearly three times higher efficiency than conventional engines)<sup>108</sup>, increase of the share of public transport in passenger transport, development of intermodal transport, transport demand management, including the promotion of sustainable mobility patterns).

**promoting energy efficiency improvement**

*Pillar I. Just transition*

All the above-mentioned actions must be accompanied by the **improvement of knowledge about rational energy consumption through various educational activities** - it is necessary to stimulate the public awareness of the energy saving potential in homes and workplaces - e.g. rational heat management, efficient fuel combustion, use of

3. PEP STRATEGIC PROJECT

<sup>108</sup> Road transport accounts for about 90% of the sector's total primary energy consumption.

energy-efficient lighting and household appliances, methods and effects of thermal modernisation. An important element will be local energy advice, as well as **activities** (e.g. campaigns) **promoting energy saving**, including energy audits.

The benefits of energy efficiency measures must be seen in the medium and long term, often beyond the payback period of the pro-efficiency investment itself. Increasing energy efficiency stimulates innovation and is also in line with the concept of a *circular economy*, which in the energy sector means more activity in the direction of using waste and by-products of combustion from the energy sector to produce energy (e.g. ash, limestone, sulphur) and using waste energy from technological processes.

In order to properly promote actions towards increasing energy efficiency, it is crucial to **ensure the exemplary role of the public sector** at each territorial level (national, regional, local) throughout PEP2040 validity period. Efficiency measures may have a wide scope – from thermal modernisation, through the purchase of products, equipment and vehicles, and the provision of services with low energy consumption (the so-called green public procurement, also taking into account innovative and pre-commercial solutions), to the implementation of an environmental management system or an energy management system. Projects in the formula of public-private partnership will also be developed, in particular in the field of street lighting. The key tasks in this area are set out in the Act on energy efficiency, but it is worth noting that additional bottom-up activities will increase efficiency in this area.

**exemplary role of the public sector**

*Pillar I. Just transition*

**In order to effectively implement the "energy efficiency first" priority, a legal framework has been established for all EU Member States.** This relate in particular to the following areas:

**legal framework for energy efficiency - ecodesign, construction, labelling**

*Pillar I. Just transition*

- **reducing energy consumption in buildings** – from January 2019 onwards, public buildings must be designed and constructed as low energy buildings<sup>109</sup>. And all newly constructed buildings will be subject to a similar requirement from January 2021. Meeting these obligations requires searching for and implementing a number of innovative solutions in terms of using proper materials, adjusting the thickness of building partitions, ventilation system, heating and lighting. These actions are of great importance for the heating sector due to the decrease in heat demand of consumers;
- **ecodesign** – in order to reduce the environmental impact, including the reduction of energy consumption, requirements are set for the design of products, including equipment for household use and those used in the service and industrial sectors, so that they have the lowest possible impact on the environment throughout their life cycle;
- **energy labelling** – regulations indicate the scope of information on energy labels to influence the consumers' awareness of the energy consumption of products and to encourage them to make energy-efficient and environmentally friendly purchases;
- **energy audits** – every "large" enterprise is required to conduct an enterprise energy audit every 4 years, unless they have an energy management system or an environmental management system under which an enterprise energy audit has been conducted. The review covers energy consumption in buildings, systems, equipment

<sup>109</sup> A detailed definition of such a building is included in the *National Plan to increase the number of low energy buildings*, 2015.

and transport. This obligation is intended to make enterprises aware of the potential of pro-efficiency measures, which at the same time should translate into a reduction of their energy costs. Meanwhile, small and medium-sized enterprises (SMEs) can be assisted by advisers to analyse their operations for energy efficiency improvement.

financial support  
for energy  
efficiency  
improvement

Pillar I. Just transition

Many times, pro-efficiency measures require significant financial outlays. Facing this challenge is facilitated by the wide offer of **financial support for undertakings aimed at the improvement of energy efficiency** in all the areas indicated above – both from domestic and external resources (including in particular the European resources). Examples of mechanisms currently used in Poland are loans, grants and other instruments offered by the National Fund for Environmental Protection and Water Management, Provincial Funds for Environmental Protection and Water Management and operational programmes of the European Funds or EU ETS funds. It is assumed that financial support for this area will be provided throughout PEP2040 perspective. The improvement of energy efficiency will also be fostered by innovative solutions, therefore it is very important to conduct developmental research in the field of solutions favouring the reduction of both primary and final energy consumption.

In financing pro-efficiency undertakings, an important issue is to ensure that the highest energy effect is achieved, which is guaranteed by the financing model based on the so-called *energy savings performance contracts*. The energy service company provides a service to improve energy efficiency at the beneficiary's premises and is remunerated (reimbursed) for the service by the savings made from the reduced cost of energy consumption resulting from the implemented solutions. Such contracts can be used in both the public and private sectors, but regulatory changes are needed to create more favourable conditions for the development of this financing model<sup>110</sup>.

"energy  
performance  
certificates"

Pillar I. Just transition

An additional mechanism that has been introduced to achieve savings in final energy consumption is a **scheme obliging a specific group of business entities** (including energy companies) **to implement a project aimed at improving energy efficiency or to purchase energy efficiency certificates** (the so-called *white certificates* confirm energy savings resulting from undertakings improving energy efficiency achieved at a

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<sup>110</sup> Barriers to the use of energy saving performance contracts in Poland have been identified, among others, in the JRC report titled *JRC Science for Policy Report Energy Service Market in the EU, Status Review and Recommendations 2019*, Boza-Kiss B, Toleikyte A, Bertoldi P. One of the main recommendations for Poland is the need to clarify the impact of EPCs on public debt. Eurostat has strengthened the possibility of off-balance sheet recording, which makes the use of contracts with ESCOs more attractive to the public sector. According to Eurostat guidance, such contracts can be recorded off-balance sheet of the government provided the project contractor is recognised as the economic owner of the installed assets. However, these guidelines are not yet reflected in Polish law.

declared level). The scheme will apply until 2030, and it will be extended or another support scheme will be specified, if necessary.

The state energy policy responds to two horizontal socio-economic problems – the so-called low-stack emissions and energy poverty, the scale of which may be reduced by improving energy efficiency.

**reduction of low-stack emissions**

**Pillar III. Good air quality**

The inefficient use of energy is one of the causes of **poor air quality**<sup>111</sup> due to emissions, especially from individual heat sources. It is caused by household combustion of low-quality coal and waste, often with improperly operated stoves and furnaces, as well as coal combustion in small local heating plants with low efficiency and traffic emissions (in terms of NO<sub>2</sub>)<sup>112</sup>.

The key element is to increase the efficiency of heat generation and consumption in the household segment. Given the fact that new buildings will meet low energy consumption requirements, reducing energy needs in existing buildings is a much greater challenge. To this end, widespread **thermal modernisation of buildings**<sup>113</sup> will be continued (insulation, replacement of doors and windows, application of smart energy management systems, increasing awareness of the effects). The next step is to **provide an efficient and ecological heat source** (district or individual)<sup>114</sup>. For activities in these areas, an important role will be played by the measures of the "Czyste Powietrze", "STOP SMOG" programmes and the Thermal Modernisation and Refurbishment Fund, which are addressed both to single-family and multi-family housing. The activity of local governments cannot be overestimated, both in terms of promotion and co-financing of projects. All the tools described, especially the programs for subsidising pro-efficiency investments within the framework of the "Czyste Powietrze" programme will be monitored and updated on an ongoing basis. In addition, **new solutions to reduce "low-stack emissions"** will also be sought.

One of the concepts of resource efficiency for consumers (both households and companies) related to the construction sector are investments in the so-called **"Climate Houses/Buildings"**. The owner of such a building would hybridise all the resources at their disposal, including: a) heat from the ground through heat pumps for heating and cooling, b) water drilled during the installation of heat pumps (both for heat recovery from such waters, which is also a potential source of domestic water), c) water from atmospheric precipitation (e.g. rainwater tanks), d) solar energy (e.g. through the installation of photovoltaic panels and solar collectors), while using energy storage and thermal modernisation technologies for buildings. Such a building using multiple technologies and resources at once could be largely independent of external supplies of electricity, heat and water.

**The development of electromobility and hydrogen-mobility as well as a number of actions planned for alternative fuels**<sup>115</sup> will also have a significant impact on reducing transport emissions. Systemic changes in transportation, i.e., popularisation of

<sup>111</sup> Although actions in the area of low-stack emissions reduction have been specified in the *National Environmental Policy 2030 - a development strategy in the area of environment and water management*, due to its strong connection with energy consumption, it is necessary to refer to this issue also in PEP2040.

<sup>112</sup> Transport contributes more to low-stack emissions in cities than in rural areas, where individual heating is the main cause of pollution.

<sup>113</sup> A long-term strategy for the refurbishment of the national residential and non-residential buildings will identify further policies and actions to stimulate building refurbishment.

<sup>114</sup> See: Specific Objective 7.

<sup>115</sup> See: Specific Objective 4C - *development of electromobility and alternative fuels*.

low-emission public transportation, *car-sharing*, energy recuperation from electric vehicles powered by traction power network (including railways, trams, and subways), or promotion of active forms of transportation, e.g., by bicycle or on foot, will also be of significant importance. In order to increase the role of **public transport** in reducing "low-stack emissions", the following targets have been set for **cities with populations over 100 thousand inhabitants**:

- from 2025 - 100% of the new fleet purchased to provide public transport services will be zero-emission (electric and hydrogen buses);
- from 2030 - fully zero-emission public transport fleet.

**reducing energy poverty**  
**Pillar III. Good air quality**











To a large extent, households affected by **energy poverty**, due to the lack of financial resources to undertake modernisation investments, burn waste, sludge and flotation concentrates, usually in buildings with poor energy performance, contribute to the phenomenon of low-stack emissions. Special conditions for support under the aforementioned programmes supporting thermal modernisation for the poorest are a key measure to combat energy poverty, as more than 80% of primary energy in households is used for space and water heating. Subsequently, aid should cover the replacement of heat sources that would prevent the burning of waste and low-quality solid fuels. Currently, the problem of energy poverty is not defined by law, which makes it difficult to identify systemic solutions to address comprehensive support for those most in need. The energy allowance which has been used so far supports the so-called *vulnerable consumers*, however neither it nor the existing support programmes provide an exhaustive answer to the problem. Therefore, work will be undertaken to modify the solutions dedicated to vulnerable consumers and to define the problem of energy poverty along with proposing new, effective and comprehensive tools to combat the problem of energy poverty, aiming to reduce its scale to **6% of households in 2030**.<sup>116</sup>



The level of energy efficiency is related to the economic development of a region, which is influenced both by the wealth of its inhabitants and the condition of local businesses. The mechanisms implemented affect the entire country, and the wide range of instruments is designed to ensure that savings are achieved for those entities that have difficulty implementing them on their own. In regional terms, a very important role is played by the Voivodeship Funds for Environmental Protection and Water Management due to the local character of the distribution of funds.

	Measures	Date	Responsible entities
	8.1. Provision of the support and development of financial support programmes (the identification and programming of funds for the implementation of support programmes)	2030	NFOŚiGW, MKiŚ, MFiPR, WFOŚiGW, MRPiT, MRiRW,

<sup>116</sup> Target calculated using the "high cost, low revenue" methodology.

	for undertakings increasing energy efficiency of the economy		others
	8.2. Provision of a legal framework for the development of energy efficiency in terms of, among others, products and energy performance of buildings	from 2020	MKiŚ, MRPiT
	8.3. Ensuring an exemplary role of the public sector at each territorial level (national, regional and local) in improving energy efficiency	the whole perspective of PEP2040	public sector
	8.4. Ensuring smooth functioning of the white certificate scheme and possible continuation after 2030.	2030 (possible continuation)	MKiŚ, URE
	8.5. Promoting energy efficiency improvement <b>8. PEP STRATEGIC PROJECT</b> 	the whole perspective of PEP2040	MKiŚ, NFOŚiGW, WFOŚiGW
	8.6. Support for widespread thermal modernisation of residential buildings and the search for new solutions to reduce low-stack emissions	the whole perspective of PEP2040	NFOŚiGW, MKiŚ, MR, MFiPR, MRiRW, WFOŚiGW
	8.7. Exploring new and effective methods to combat energy poverty	the whole perspective of PEP2040	MKiŚ
	<i>- energy security, environmental impact</i>		
	<i>- economic competitiveness,</i>		
	<i>- reduction of the sector's</i>		

## 4. Implementation and monitoring of PEP2040

### Implementing entities

A number of entities are responsible for the implementation of the *Energy Policy of Poland until 2040* – government and self-government administration bodies, government institutions, entities of the fuel and energy sector, as well as business entities that carry out statutory obligations and implement good practices in the use of energy. The list also includes households that are active on the energy market, but should also take care of the rational use of energy. The entities particularly involved in the implementation of the state energy policy are presented below, along with a brief description of their roles.

**The minister responsible for energy, climate and environment** has a leading and coordinating role in the development and implementation of the state's energy policy, in accordance with the provisions of the Act of 10 April 1997 – Energy Law. Moreover, he is responsible for the raw materials policy, and in this respect for the coordination of exploration, documentation and development of energy deposits. The minister is in charge of the Material Reserves Agency and supervises the President of the State Atomic Energy Agency, the Chief Inspector of Environmental Protection, the Institute of Environmental Protection – State Research Institute, the State Geological Institute – State Research Institute, the Institute of Ecology of Industrial Areas, as well as the activities of the National Fund for Environmental Protection and Water Management and of the provincial funds for environmental protection and water management.

**The minister responsible for state assets** supervises companies in the energy sector and exercises the property rights vested in the State Treasury with respect to these companies; the President of the State Mining Authority also reports to him.

Within the framework of the state energy policy, **the minister responsible for the environment** manages and is in charge of the raw materials policy, and in this respect coordinates the exploration, documentation and management of energy source deposits.

**The President of the Energy Regulatory Office** is a central, independent government administrative body that performs tasks related to the regulation of fuel and energy management (in particular, tariffing and licensing) and the promotion of competition. The President of URE regulates the activities of energy enterprises with the aim of balancing the interests of energy enterprises and consumers. He or she is also responsible for keeping a wide range of registers and lists, as well as conducting auctions for the sale of electricity from RES.

**The Government Plenipotentiary for Renewable Energy Sources** coordinates actions aimed at the development of RES use, development of electromobility and energy storage, improvement of energy efficiency.

**The Government Plenipotentiary for Strategic Energy Infrastructure** exercises corporate supervision of the State Treasury over the electricity transmission system operator, gas transmission system operator and PERN S.A.

**The Government Plenipotentiary for National Raw Materials Policy** prepares a concept shaping the state raw materials policy, as well as coordinates and initiates activities in its scope, including the development of new legal and economic solutions.

**The President of the State Atomic Energy Agency** is the central authority of the government administration competent in matters of nuclear safety and radiological protection, and of key importance for the implementation of PEP2040 is the preparation of draft documents concerning the state policy in the area of nuclear safety and radiological protection, taking into account the PPEJ and internal and external threats.

**The National Fund for Environmental Protection and Water Management and the 16 Voivodeship Funds for Environmental Protection and Water Management** are state legal persons whose aim is to finance environmental protection and water

management. In implementing the state energy policy, NFOŚiGW / WFOŚiGW are responsible in particular for financing widely understood green investments.

**The minister responsible for economy and the minister responsible for construction, planning and spatial development and housing** takes actions related to energy aspects of construction, including improvement of energy efficiency of buildings, and cooperates in the implementation of energy policy in the field of planning and spatial development. In addition, it cooperates in particular on the competitiveness of economic operators (including energy-intensive enterprises) with regard to the impact of the burden resulting from energy purchases and supports measures relating to energy production for own use by industrial enterprises.

**The minister responsible for regional development** coordinates the development and implementation of the development strategy and cooperates in the area of obtaining development funds from the European Union for the needs of the energy sector.

Within the framework of the state energy policy, **the minister responsible for agriculture and rural development** undertakes activities concerning electrification and gasification of rural areas, as well as certain activities related to the energy potential of rural areas, and also a broadly understood issue of biomass, biogas, bio-components and biofuels.

**The minister in charge of transport** is responsible for the implementation of actions relating to transport traffic, the operation and development of transport infrastructure, in particular for the construction, modernisation, maintenance and protection of public roads, including motorways, and railways, airports and ports, as well as public transport, which is of significant importance for energy consumption by such an important sector, and also due to the impact of transport on air quality.

**The minister in charge of maritime economy and inland waterway transport** is responsible in particular for the implementation of the activities related to the development of port infrastructure and the development of the maritime areas of the Republic of Poland for energy purposes and also cooperates in the field of the use of hydroelectric potential; moreover, he carries out activities related to the environmental aspects of water use (influence on the use of water by the energy sector).

**The minister responsible for foreign affairs** ensures support for the implementation of activities included in the state energy policy to the extent to which they relate to Poland's relations with other states and international organisations and are connected with representing and protecting Polish interests abroad.

**The minister responsible for public finance** cooperates in the implementation of the energy policy, in particular with regard to activities relating to the determination of the rules for the realisation of revenues from direct and indirect taxes and charges on entities operating in the energy sector. He cooperates in obtaining loans from international financial institutions for public and private investments in the area of energy, including energy efficiency.

**The minister in charge of information technology** is responsible for the best use and strengthening of key digital capabilities necessary for cyber security in the fuel and energy sector and aimed at the implementation and development of innovative digital technologies in the sector, especially in smart grids.

**The minister responsible for science and higher education** undertakes actions aimed at developing the system of science and higher education to meet market needs.

**The minister responsible for education and upbringing** undertakes actions to ensure coordination of the Integrated Qualification Register which serves the purpose of uniformity of qualifications for professions in the energy sector which are included in the Integrated Qualification System.

**The Government Security Centre** ensures in particular the circulation of information between domestic and foreign authorities and crisis management structures and

monitors the implementation of executive activities of the energy sector resulting from the Crisis Management Act and the National Programme for Critical Infrastructure Protection.

**Transmission system operators** and electricity, gas and oil **distribution system operators**, within the framework of the implementation of the state energy policy, carry out in particular such activities as the preparation of network development plans, as well as the restoration and reinforcement of existing interconnections and the construction of new ones, in particular to allow cross-border exchange with neighbouring countries.

**The storage system operator**, within the framework of the implementation of the state energy policy, conducts in particular such activities as ensuring the operation, maintenance, overhauls and expansion of storage facilities and equipment in a manner guaranteeing the security and reliability of their operation, as well as disposing of the capacity of the storage facilities.

**Local government units** (communes, poviats, voivodeships) are responsible for the implementation of the state energy policy at a local level, including energy planning activities at the local level, involvement in the local low-emission economy and support for energy consulting entities.

**Scientific and research institutes and universities** conduct research and development work on innovative solutions and carry out activities aimed at their market implementation, taking the adaptation of scientific work to market needs into account. They also initiate, coordinate and perform tasks aimed at the recognition of the geological structure of the country.

**The entities of the sector** - power companies, coal companies, oil companies, gas companies, refinery companies, energy trading companies, companies implementing the National Indicative Target - perform certain activities within the scope of the state energy policy, in particular in the area of initial investment.

**Enterprises and households** are the main stakeholders of the state energy policy, the implementation of which is to provide them with stable access to energy at acceptable prices. In recent years, they are also becoming more and more active in roles that were previously unavailable - i.e. an energy producer or a provider of demand management services.

## **Policy update and monitoring system**

Pursuant to the legal provisions included in the Energy Law, the *Energy Policy of Poland until 2040* will be periodically updated. Given the close linkage with the *National Energy and Climate Plan 2021-2030*, the upcoming update of PEP will be carried out in synergy with the work on updating the *National Plan* in 2023.

The implementation of the *Energy Policy of Poland until 2040* will be monitored at the level of the main objective and indicators described in chapter 7 and 8, as well as at the level of detailed objectives and strategic projects. A report on the implementation of PEP2040 strategic projects will be an element of the annual Report on the implementation of the *Strategy for Responsible Development* (Appendix 2: The status of implementation of new strategic projects included in individual development strategies).

The strategic projects included in PEP2040 will be subject to ongoing operational monitoring conducted by the Government Project Monitoring Office in the Chancellery of

the Prime Minister and cyclical operational monitoring conducted by the Ministry of Funds and Regional Policy<sup>117</sup>.

## 5. Territorial dimension

The *Energy Policy of Poland until 2040*, by setting long-term directions for national transition and development of the fuel and energy sector, will affect decisions taken at the regional level, including investment processes, operation and development of industry, the labour market, the economic and social condition of regions. These decisions will also have implications for planning and programming at local level, given the need to preserve synergies between national and territorial strategies, stimulating targeted economic development.

A key issue that will allow effective implementation of the *Energy Policy of Poland until 2040* at the regional level will be to change the existing system of planning coverage of demand for fuel and energy in communes. At present, the involvement of local government units in the implementation of such plans on a national scale is low, which may limit the economic and social development of a given region. Such plans allow for the identification of needs and potentials, and then form the basis for initiatives to build or develop the district heating network, distribution of electricity, or access to natural gas. The development of the district heating network is of particular importance for reducing low-stack emissions and preventing the emergence of new emission sources as a result of the expansion of residential infrastructure. The development of the electricity and gas distribution network is also important to reduce emissions from the domestic and municipal sectors, and is a boost to the development of economic activity. Areas which are equipped with such utilities are much more attractive for investors than the ones which need to be connected to the grid.

The activity of local government units at every level in creating activities aimed at low-emission economy and activation of inhabitants will also be of great importance. Depending on the support programs developed, local authorities may be involved in the disbursement of funds for these purposes.

Energy companies involved in the transmission or distribution of gaseous fuels or energy are obliged to ensure the implementation and financing of network construction and development, including for the purposes of connecting entities applying for connection, under the conditions laid down in the *Energy Law* and the energy planning documents referred to above. The investments identified in the electricity and gas network development plans are aimed at upgrading those lines whose technical condition has the greatest impact on network disturbances but also on responding to the needs of economic development. However, it should be emphasized that the development of gas distribution networks depends on the distance from the transmission infrastructure as well as the scale of the identified demand. The development of the power grid, similarly to the development of the gas network, must be economically justified and correlated with the economic development plans of the regions concerned and with the development of the infrastructure for electric vehicles.

The above activities will have a positive impact on activation of **areas at risk of permanent marginalisation<sup>118</sup> indicated in SOR**. Taking into account the distribution of these areas, the current state of the network and the plans for investment activities,

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<sup>117</sup> Project monitoring is carried out with the use of an IT tool, MonAliZa. The system ensures uniformity of monitoring applicable to the projects of all integrated strategies, taking into account the specific nature of the organisation, the scope of the project, good practice and recommended standards. Designated project leaders provide the data necessary to feed the MonAliZa system and through it indicate, among others, risks and results achieved.

the development of the gas network will particularly affect such areas located in North-Eastern Poland, while the development of the power grid will affect such areas in North-Western Poland. The power grid is developing evenly across the country, although Eastern Poland, due to its economic development and the development of photovoltaics, will be particularly affected by these investments, as will the northern part of Poland, where wind power plants will develop more intensively.

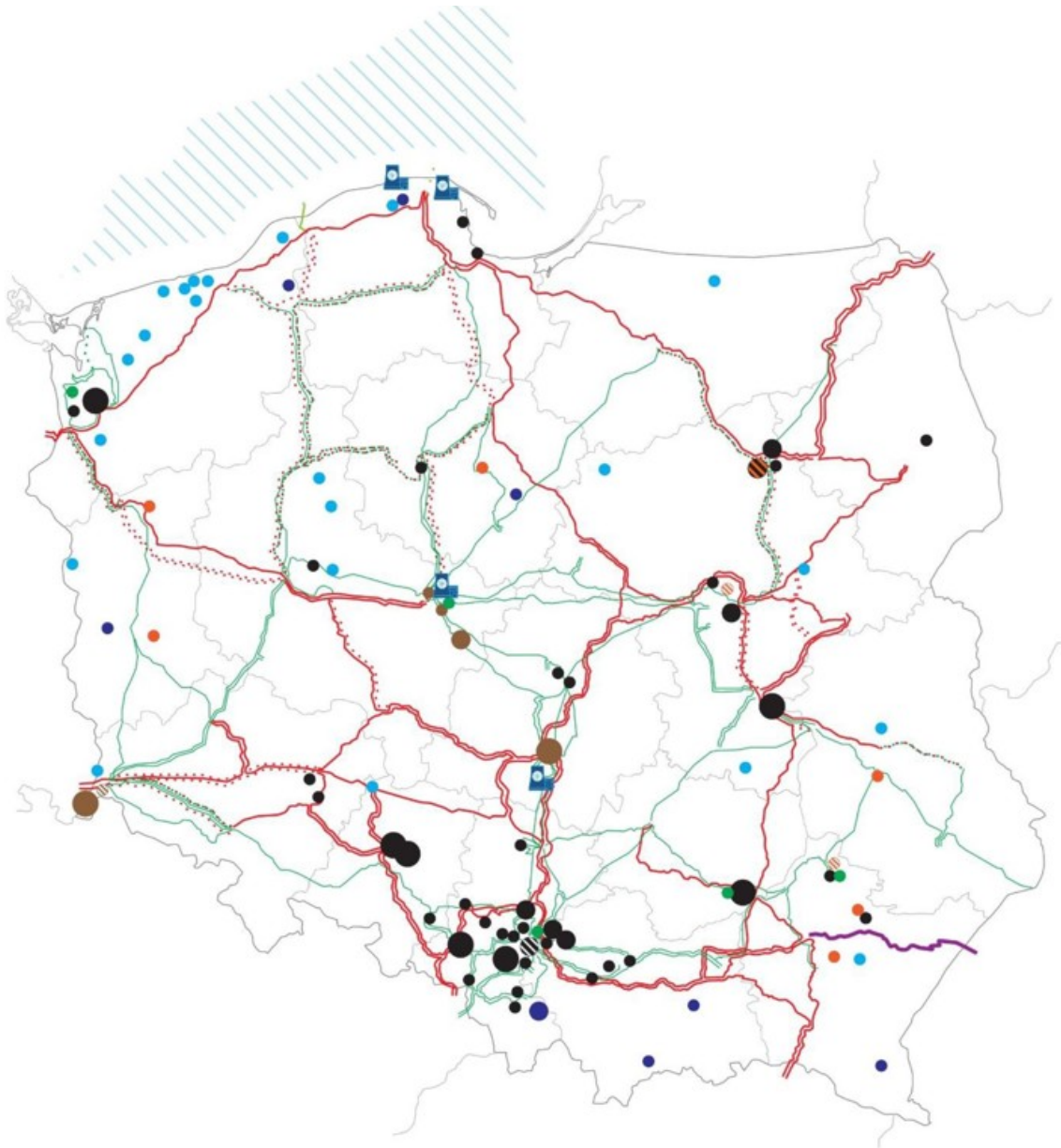
In territorial terms, special attention should be paid to regions where the end of operation of an energy generation unit or termination of a mine operation is associated with the need to reformulate the labour market or economic importance – Silesia, Lower Silesia, Greater Poland, Lesser Poland, Łódź and Lublin Voivodeships. Parts of the labour market will transform naturally, but support will be needed to retrain workers, stimulate investment and generate new jobs. This will be strongly supported by dedicated EU and national funding<sup>119</sup>. Other regions of Poland will also be able to benefit from various forms of support, as the transition requires the involvement of the entire country – from local governments, through enterprises to individual consumers. Implementing the transition is not only a challenge, but also an opportunity to use national and regional potentials. The emergence of new industries and jobs related to the development of civic power generation based on renewable energy sources, as well as promising sectors such as nuclear power, electromobility, construction, thermal modernisation, decarbonised gas technologies (including hydrogen), energy storage, automation and digitalisation will be stimulated. It is estimated that around 300 thousand new jobs will be generated in this way – more than three times the current employment in hard coal and lignite mining, which in 2018 amounted to nearly 82 thousand. The development of offshore wind energy itself can generate more than 60 thousand jobs, with cement plants, steel mills and shipyards, among others, being involved. This is an opportunity for hundreds of Polish entrepreneurs and for increasing added value in the national economy.

Below are four maps that show (1) the status and development of the electric power system, (2) the status and development of the gas system, (3) the status and development of the oil, liquid fuel and CNG/LNG refuelling base infrastructure, and (4) the installed capacity and electricity production from RES by voivodeship. The maps were compiled as of the end of 2019, while in the case of map (4) the data is for 2018. Especially the CNG/LNG refuelling base is particularly dynamic and can be monitored on an ongoing basis on the website: <https://eipa.udt.gov.pl/>. On this page it is also possible to precisely locate electric vehicle charging bases, which, due to their large number and dynamic growth, are not shown on the map in this document. Maps (1)-(3) show the key flagship investments that can be located. In the case of RES, its development is not top-down oriented to particular types in individual locations/provinces. It is the investor who decides, within the framework of the applicable law, what type of investment is economically justified in their opinion, taking into account e.g. local wind conditions, sunlight, earth heat, or biomass resources. PEP2040 does not indicate in which areas a particular type of renewable energy should be more strongly developed (apart from offshore wind energy), as it is not justified from the point of view of the development of distributed energy throughout the country.

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<sup>118</sup> See Fig. 12. Areas at risk of permanent marginalisation, *Strategy for Responsible Development...*, p. 179, 2017.

<sup>119</sup> See 1. Introduction.



**MAP OF THE CONDITION AND DEVELOPMENT OF THE POWER SYSTEM IN POLAND**

Power plants and CHP power plants over 50 MW	Installed capacity (MW)	Transmission grids
<ul style="list-style-type: none"> <li><span style="display: inline-block; width: 10px; height: 10px; background-color: black; border-radius: 50%;"></span> hard coal</li> <li><span style="display: inline-block; width: 10px; height: 10px; background-color: brown; border-radius: 50%;"></span> lignite</li> <li><span style="display: inline-block; width: 10px; height: 10px; background-color: orange; border-radius: 50%;"></span> gas</li> <li><span style="display: inline-block; width: 10px; height: 10px; background-color: green; border-radius: 50%;"></span> biomass</li> <li><span style="display: inline-block; width: 10px; height: 10px; background-color: blue; border-radius: 50%;"></span> water</li> <li><span style="display: inline-block; width: 10px; height: 10px; background-color: cyan; border-radius: 50%;"></span> wind</li> <li><span style="display: inline-block; width: 10px; height: 10px; background-color: lightblue; border: 1px solid blue; border-radius: 50%;"></span> potential locations for nuclear power plants</li> </ul>	<ul style="list-style-type: none"> <li><span style="display: inline-block; width: 10px; height: 10px; border: 1px solid black; border-radius: 50%;"></span> up to 500 MW</li> <li><span style="display: inline-block; width: 15px; height: 15px; border: 1px solid black; border-radius: 50%;"></span> up to 1000 MW</li> <li><span style="display: inline-block; width: 20px; height: 20px; border: 1px solid black; border-radius: 50%;"></span> over 1000 MW</li> <li><span style="display: inline-block; width: 15px; height: 15px; border: 1px solid black; border-radius: 50%; background: repeating-linear-gradient(45deg, transparent, transparent 2px, black 2px, black 4px);"></span> under construction</li> <li><span style="display: inline-block; width: 20px; height: 10px; background: repeating-linear-gradient(-45deg, transparent, transparent 2px, black 2px, black 4px);"></span> zone of possible locations of offshore wind power plants</li> </ul>	<ul style="list-style-type: none"> <li><span style="display: inline-block; width: 20px; height: 2px; background-color: purple;"></span> 750 kV transmission lines</li> <li><span style="display: inline-block; width: 20px; height: 2px; background-color: green;"></span> 450 kV transmission lines (submarine cable)</li> <li><span style="display: inline-block; width: 20px; height: 2px; background-color: red;"></span> 400 kV transmission lines</li> <li><span style="display: inline-block; width: 20px; height: 2px; background-color: cyan;"></span> 220 kV transmission lines</li> <li><span style="display: inline-block; width: 20px; border-bottom: 2px dashed black;"></span> planned and under construction transmission lines</li> <li><span style="display: inline-block; width: 20px; border-bottom: 2px dotted black;"></span> 400 kV transmission lines temporarily operating at 220 kV</li> </ul>

Source: own study by the Ministry of Climate based on data from the Ministry of Climate and Environment and PSE S.A.

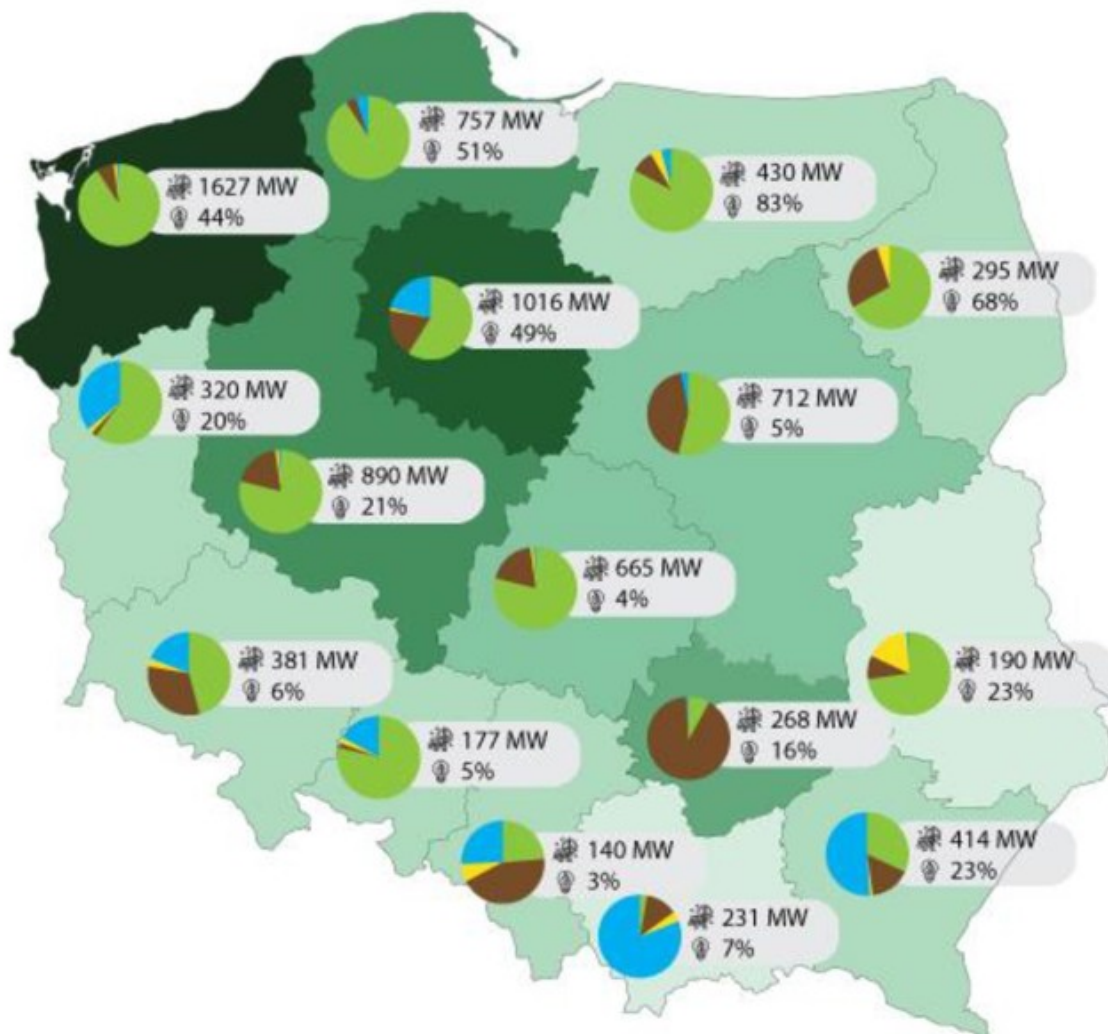


## MAP OF THE CONDITION AND DEVELOPMENT OF THE POLISH GAS SYSTEM

Point infrastructure	Linear infrastructure
LNG terminal	Yamal gas pipeline
planned LNG terminal	transmission pipelines
underground high-methane gas storage facility	planned and upgraded gas transmission pipelines
planned underground storage facility with possible hydrogen storage under consideration	distribution pipelines

Source: own study by the Ministry of Climate and Environment based on own data and data from Gaz-System S.A.





**MAP OF INSTALLED CAPACITY AND ELECTRICITY PRODUCED FROM RENEWABLE SOURCES**

Electricity production from RES [GWh]	Type of RES sources in the capacity structure	Capacity and share of RES in electricity production
<ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: #e0f2f1; border: 1px solid #ccc; margin-right: 5px;"></span> up to 500</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: #c8e6c9; border: 1px solid #ccc; margin-right: 5px;"></span> up to 1000</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: #a5d6a7; border: 1px solid #ccc; margin-right: 5px;"></span> up to 1500</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: #81c784; border: 1px solid #ccc; margin-right: 5px;"></span> up to 2000</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: #66bb6a; border: 1px solid #ccc; margin-right: 5px;"></span> up to 2500</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: #43a047; border: 1px solid #ccc; margin-right: 5px;"></span> up to 3000</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: #2e7d32; border: 1px solid #ccc; margin-right: 5px;"></span> up to 3500</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: #1e8449; border: 1px solid #ccc; margin-right: 5px;"></span> up to 4000</li> </ul>	<ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: #00bcd4; border: 1px solid #ccc; margin-right: 5px;"></span> hydropower sources</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: #795548; border: 1px solid #ccc; margin-right: 5px;"></span> biomass and biogas sources</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: #ffeb3b; border: 1px solid #ccc; margin-right: 5px;"></span> solar sources</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: #8bc34a; border: 1px solid #ccc; margin-right: 5px;"></span> wind resources</li> </ul>	<ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: #ccc; border: 1px solid #ccc; margin-right: 5px;"></span> installed capacity of RES plants</li> <li><span style="display: inline-block; width: 15px; height: 15px; border: 1px solid #ccc; margin-right: 5px;"></span> share of RES in electricity production</li> </ul>

Source: own study by the Ministry of Climate and Environment based on own data

## 6. Financial framework and funding sources of PEP2040

The provisions of the *Strategy for Responsible Development* and current forecasts on the structure of potential sources of financing for development activities provided for in SOR indicate that **after 2020, the burden of financing development investments will be shifted to a greater extent to national resources (both public and private)**. The importance of EU funds will be relatively lower, although still significant.

**The public sector tasks**, which so far have been implemented to a large extent with co-financing from the EU, **will be financed to a greater extent with national public funds**. These funds will come from the central budget and from local government budgets, which will become more important in financing the development effort. The reason for this is the expected reduction of the pool of funds for Poland under the cohesion policy and the Common Agricultural Policy in the financial perspective 2021-2027.

It should be borne in mind that the implementation of development projects must take place **while maintaining macroeconomic stability**, including in particular the public finance sector. Fiscal policy has to take into account the constraints imposed by existing financial rules and aim at gradually reaching the medium-term objective for the budgetary position, which would put the public debt on a sustainable path. This indicates the necessity of effective stimulation of **private sector investments** (from domestic and foreign funds) and further **improvement of the effectiveness of public sector development expenditures**. The use of EU funds should be concentrated on projects with the highest added value and positive external effects. Assessing the conditions for pursuing economic policy (including in particular the investment policy) in the forthcoming years, measures related to SOR implementation will lead to the **mobilisation of private capital** (domestic and foreign), which will have an impact on increasing its investment activity. Given the need to ensure sustainability of public finances, it is **private capital that will play a key role in achieving the planned rate of investment in the economy**. This is particularly important in the context of rebuilding and strengthening the resilience of the economy after the COVID pandemic.

On the other hand, it should also be remembered that it is the actions implemented by the **public sector (both investment and regulatory)** that favour the improvement of "boundary conditions" determining the economic rationality and profitability of private sector entities. This is because they contribute to the creation of attractive conditions conducive to economic activity and enhancing its efficiency (among others through the **development of infrastructure necessary for the activity of economic entities and creation of an institutional framework effectively supporting the economic growth**).

The dynamic development of the private sector results in an increase in its revenues and profits with a simultaneous increase in wages of the labour factor (enabled by rising productivity) will in turn lead to an **increase in budget revenues**. This will thus contribute to **an increase in general government revenues, ensuring the possibility of financing of tasks arising from state functions**.

It is assumed that thanks to the above presented directions of changes in the structure of development funds spent on the implementation of the strategy objectives, the share of these funds in the GDP will be high enough to ensure effective completion of the strategic tasks. This should be supported by the macroeconomic condition of the Polish economy in the coming years. Forecasts from both domestic institutions and reputable international centres point to the possibility of a **continued relatively high** rate of economic growth (although lower than both that recorded in 2017-2018 and that forecast for 2019-2024).

According to the long-term forecasts of the Ministry of Finance<sup>120</sup>, in the years 2025-2030 the real economic growth rate will vary from 3% in 2025 to 2.7% in 2030, which will translate into an average annual growth rate in that period of 2.8%. **Along with the economic growth, the revenues of the public finance sector will increase, which should make it possible to finance the development activities within the scope of their planned implementation from public funds.**

Also noteworthy is the ongoing work in the EU on **taxonomy, a single EU classification system to engage private capital in financing the low-emission transition**. Harmonised criteria will be introduced to determine whether a particular economic activity is environmentally sustainable. The taxonomy will apply to financial products that incorporate sustainability criteria into their investment strategy. It is likely that the cost of private equity financing for an activity that is not perceived to be sustainable will be higher than for an economic activity perceived to be sustainable – meaning that it will be more difficult to finance through commercial debt.

**PEP2040 financial framework** is based on parts and sections of the state budget, expenditures of government entities, the budget of EU and other foreign funds. A significant part of expenditures will be covered by funds of companies from the fuel and energy sector, other private funds or debt financing. The pool of sources also includes support schemes that indirectly cover energy consumers.

The next table lists the sources of funding that will contribute to the implementation of PEP, but they do not **exhaust the catalogue of funding sources**. The horizon for the disbursement of these funds is shorter than PEP2040 perspective, but at the same time new instruments are being created that can be used to implement the policy. The directions and tasks of PEP2040 should also constitute one of the determinants of the financial engineering of new programmes, funds and reserving resources for implementation. It should also be noted that in many cases PEP2040 indicates problems for which solutions are not known or their details are not fully determined, and sources of funding will be part of those solutions. It has been estimated that the **energy transition of Poland** planned in PEP2040, carried out in a socially acceptable manner, while ensuring energy security, maintaining competitiveness of the economy and limiting environmental impact, will require huge investment outlays, the scale of which may reach approx. **PLN 1,600 billion** in 2021-2040. In the entire fuel and energy sector, they may amount to approx. **PLN 867-890 billion**, while in non-energy sectors (industry, households, services, transport and agriculture) the amount may reach approx. **PLN 745 billion**.

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<sup>120</sup> *Guidelines concerning the application of uniform macroeconomic indicators as the basis for estimating the financial effects of proposed acts.*

## PEP2040 financial framework defined in the state budget in multi-year planning

In terms of forecasts, the financial framework of the Strategy is only an estimate showing the possible order of magnitude of expenditure, but the implementation of tasks of the Strategy within the framework of national budgetary resources will take place within the limits of funds for individual trustees, determined in the course of work on the draft budgetary law for the year without the need to increase them from the state budget.

Specific and emergency arrangements have been put in place to offset the negative economic impact of the COVID-19 pandemic in 2020. The aforementioned actions have significant implications for the shape and condition of the state budget in 2020, with likely implications in future years. Due to the ongoing pandemic, it is not possible to fully assess its impact. In view of the above, the data contained in the table below, in particular for the years 2021-2025, should be considered as an estimated, non-binding forecast.

(PLN million)	2016	2017	2018-2020	2021-2025
<b>DEVELOPMENT EXPENDITURE OF THE STATE BUDGET ACCORDING TO THE DEFINITION OF THE DEVELOPMENT EXPENDITURE CLASSIFICATION - DEC (consolidated, except for grants to local authorities)</b>				
<b>47. Energy</b>	<b>17.96</b>	<b>16.86</b>	<b>52.24</b>	<b>87.06</b>
<b>48. Mineral deposit management</b>	<b>1068.91</b>	<b>3013.47</b>	<b>6123.57</b>	<b>10205.95</b>
<b>Total</b>	<b>1086.87</b>	<b>3030.34</b>	<b>6175.81</b>	<b>10293.02</b>
<b>DEVELOPMENT SUPPORT EXPENDITURE NOT COVERED BY THE DEC</b>				
<b>47. Energy</b>	<b>51.45</b>	<b>56.91</b>	<b>162.55</b>	<b>270.91</b>
<b>48. Mineral deposit management</b>	<b>20.95</b>	<b>27.19</b>	<b>72.21</b>	<b>120.35</b>
<b>Total</b>	<b>72.40</b>	<b>84.11</b>	<b>234.76</b>	<b>391.26</b>
<b>EXPENDITURE BY OTHER GOVERNMENT AND SELF-GOVERNMENT UNITS (where final expenditure is not shown, it is the amount of the grant from the BP to the unit)</b>				
Low-Emission Transport Fund (from 10.2020 means under NFOŚiGW)	0.00	0.00	857.30	4029.20
Other general government and self-government units	13.59	152.92	249.77	416.28
<b>Total</b>	<b>13.59</b>	<b>152.92</b>	<b>1107.07</b>	<b>4445.48</b>
<b>COHESION POLICY EXPENDITURE AND CO-FINANCING</b>				
Energy	799.40	2474.56	12702.99	11262.44
R&D and entrepreneurship	217.66	145.56	1409.28	1249.47
<b>Total</b>	<b>1017.06</b>	<b>2620.12</b>	<b>14112.27</b>	<b>12511.91</b>
<b>EXPENDITURE UNDER OTHER FOREIGN INSTRUMENTS AND FUNDS</b>				
CEF	10.80	5.20	24.00	40.00
Norwegian Financial Mechanism, EEA Financial Mechanism	137.48	207.46	517.41	862.35
<b>Total</b>	<b>148.28</b>	<b>212.66</b>	<b>541.41</b>	<b>902.35</b>
<b>TOTAL</b>	<b>2338.20</b>	<b>6100.15</b>	<b>22171.32</b>	<b>28544.02</b>

## List of possible financing sources for PEP2040 - national and international funds<sup>121</sup>

name / type	funding area	amount of funds	time frame	additional information
RES support schemes: a) "green certificates" and "blue certificates" - aid number: SA.37345 (2015/NN), b) energy purchase auctions for electricity produced from RES - aid number: SA.43697 (2015/N), c) FiT and FiP tariffs - aid number: SA.51852 (2018/X)	development of renewable energy sources	a) PLN 450 million (annually)  b) PLN 40,000 million  c) PLN 622.2 million	2040*	The amount of funds for "green certificates" is an estimate (it is also not a maximum amount), taking into account the fact that the price of certificates of origin is set on the market. *The support schemes were adopted for the period, respectively: a) until 30.06.2016, b) until 30.06.2021 (possible auctions), c) until 30.06.2021, According to the EC decision on notification of RES support scheme, the auction mechanism should not exceed the indicated amount by 2040.
Support scheme - capacity market - aid number: SA.46100 (2017/N)	providing an investment stimulus for a stable and secure energy supply	approx. PLN 4,000 million (annually)	2020-2042	The cost of the mechanism will be included in electricity bills. Valid from Q3 2020. The system was approved by the EC for the period of 10 years counting from the date of the first auction, however, the payments of the aid granted under this system will be made also after this period.
Support scheme for high-efficiency cogeneration - aid number SA.51192 (2019/N)	development of high-efficiency cogeneration	PLN 36,300 million	2019-2048	The cost of the mechanism will be included in electricity bills. The support scheme was approved by the EC for the period of 10 years, however, the payments of the aid granted under this system will be made also after this

<sup>121</sup> This list is not an exhaustive catalogue of PEP2040 funding sources, compiled according to information available at the end of Q2 2020. Where indicated as "-", the amount or time frame is difficult to determine.

name / type	funding area	amount of funds	time frame	additional information
				period. Support will only be available to units whose carbon dioxide emissions/carbon intensity meet the levels set out in the Act.
Aid scheme SA.52832 (2019/N) – Poland – Modification of State aid to the Polish coal sector from 2015 to 2023	aid to cover exceptional costs and, until 2016, for the closure of coal production units	PLN 12,991.97 million, including PLN 320.33 million for closing production units	2015–2023	Aid is granted in the form of: grants; exemptions from mandatory fees and penalties, exemptions from payments to PFRON and fees and penalties to NFOŚiGW and PGWWP; exemptions from tax on civil law transactions (PCC); exemptions from corporate income tax (CIT); exemptions from profit sharing; exemptions from the obligation to obtain concessions for methane extraction. -
NFOŚiGW funds, including: a) <i>Energia Plus</i> b) <i>Ciepłownictwo Powiatowe – pilotaż</i> c) <i>Agroenergia</i> d) <i>Polska Geotermia Plus</i> e) <i>Mój Prąd</i> f) <i>Co-financing of projects financed under Axis I of OPI&amp;E 2014-2020</i> g) <i>„Czyste Powietrze” Programme</i> h) <i>Funds from NFOŚiGW's long-term commitment for the development of low-emission transport*</i>	measures to improve energy efficiency, low-emission energy sources, including renewable energy sources and high-efficiency co-generation district heating environmental education other green investments air quality improvement low-emission transport, including the development of electromobility and transport based on alternative fuels	a) <i>PLN 4,000 million</i> b) <i>PLN 500 million</i> c) <i>PLN 200 million</i> d) <i>PLN 600 million</i> e) <i>PLN 1,000 million</i> f) <i>PLN 2,000 million</i>  g) <i>PLN 103,000 million</i>	2019–2025/2027*	Details of power sources of NFOŚiGW and offers available at: <a href="http://www.nfosigw.gov.pl/o-nfosigw/">http://www.nfosigw.gov.pl/o-nfosigw/</a> and <a href="http://nfosigw.gov.pl/oferta-finansowania/">http://nfosigw.gov.pl/oferta-finansowania/</a> e) The <i>Mój Prąd</i> Programme is funded from the Climate Account, the funds come from the ETS and the NFOŚiGW acts as the National Green Investment Scheme Operator. h) The "Czyste Powietrze" Programme includes grants (also those provided under the Stop Smog Programme), loans for communes, and a thermal modernisation tax deduction – PLN 63.3 billion. Loans provided by banks: PLN 40 billion.

<b>name / type</b>	<b>funding area</b>	<b>amount of funds</b>	<b>time frame</b>	<b>additional information</b>
		h) PLN 6,700 million		h) Funds for this purpose may be used for e.g. fleet acquisition, charging infrastructure, public transportation, promotional and educational activities. The funds come from purpose-specific subsidies from the state budget, funds transferred by the TSO, income from the substitution fee and the emission fee.
Thermal Modernisation and Refurbishment Fund	thermal modernisation undertakings	-	from 1999	Fund provisioned by the state budget. Between 1999 and 2018, PLN 2,575 million was transferred to the Fund, further amounts are difficult to determine. <a href="https://www.bgk.pl/samorzady/fundusz-e-i-programy/fundusz-termomodernizacji-i-remontow/">https://www.bgk.pl/samorzady/fundusz-e-i-programy/fundusz-termomodernizacji-i-remontow/</a>
"White certificates" support scheme	improvement of energy efficiency in business	-	2030	Possible extension of the time frame
NCBiR funds, research projects	research and development, early implementation of innovative solutions	-	-	National resources, EU resources and other resources available from international programmes
European funds – operational programmes in the financial perspective 2014-2020	a)RES b)energy efficiency in buildings c)energy efficiency in business d)heat distribution networks e)high-efficiency cogeneration f) electricity infrastructure g)gas infrastructure	a) EUR 1,217 million b) EUR 2,240 million c) EUR 227 million d) EUR 408 million e) EUR 367	2014-2020	Funds in the process of disbursement, performance of projects to implement PEP2040, even until 2023. <a href="http://www.funduszeuropejskie.gov.pl/">http://www.funduszeuropejskie.gov.pl/</a>

<b>name / type</b>	<b>funding area</b>	<b>amount of funds</b>	<b>time frame</b>	<b>additional information</b>
		f) million EUR 700 million g) EUR 620 million		
European funds - operational programmes in the financial perspective 2021-2027	a)RES b)energy efficiency in buildings c)energy efficiency in business d)heat distribution networks e)high-efficiency cogeneration f) electricity infrastructure g)gas infrastructure	Estimated above 6,000 million EUR (presumably approx. EUR 3,000- 4,000 million in national programmes and a similar allocation in Regional Operational Programmes)	2021-2027	Measures at the stage of financial engineering - neither the total framework of the funds nor the breakdown by programme is known
European Funds - Connecting Europe Facility (CEF)	construction and upgrading of energy infrastructure, smart grids, CCS (including Projects of Common Interest - PCIs)	PLN 40.00 million	2021-2025	
European Funds - "Green Deal for Europe" Just Transition Fund	transition of mining regions	EUR 3,500 million	2021-2027	
Modernisation Fund	modernisation of the energy sector	approx. EUR 2,000 - 4,800 million	2021-2030	The fund will be financed by auctioning 2% of all EU ETS allowances. The amount of funds depends on allowance prices. The Fund will be available to EU countries where GDP <i>per capita</i> is below 60% of the EU average, including Poland. Energy generation projects using solid fuels will be excluded, except for district heating in

<b>name / type</b>	<b>funding area</b>	<b>amount of funds</b>	<b>time frame</b>	<b>additional information</b>
				Bulgaria and Romania.
InvestEU	low-emission infrastructure, R&D, SMEs, competence building	Estimated above EUR 6,000 - 7,000 million (difficult to estimate allocation to energy sector)	2021-2027	Under the existing <i>Investment Plan for Europe</i> (Juncker Plan) programme, more than EUR 3.7 billion have been allocated for investments in Poland, worth almost EUR 18.6 billion.
EU Recovery and Resilience Facility	"green" transition of economy (including energy area), digital transition	Estimated approx. EUR 21,900 million	2021-2031	A new programme to give investment impetus for green economic transition and digital transition during the economic downturn caused by COVID-19.
Horizon Europe	research and development	-	2021-2027	Successor to Horizon 2020
LIFE Programme	environment and climate protection	approx. EUR 5,000 million	2021-2027	Continuation of a programme launched in 1992.
Structural reform support programme	support of national institutions (ministries, central units and local governments) in the implementation of structural reforms	EUR 222.8 million*	2014-2020	*The amount is the total (for all EU Member States) budget of the instrument; the implementation of the projects supports the implementation of PEP2040
Norwegian Financial Mechanism, EEA Financial Mechanism	high-efficiency co-generation, upgrading of heating networks and sources, improvement of energy efficiency in schools, geothermal energy, small hydro power, pellet production projects	EUR 111.289 million	2021-2024	The amount includes a grant available for the indicated activities and national co-financing.
International Financial Institutions, including the World Bank, EIB, EBRD	in particular, anti-smog measures, improvement of energy efficiency, renewable energy	-	-	Programmes and mechanisms are developed on an ongoing basis in response to observed needs

## 7. List of PEP and SOR strategic projects

The *Strategy for Responsible Development - until 2020 (with an outlook to 2030)* - SOR, adopted by the Council of Ministers on 14 February 2017, is the key document of the Polish State in the area of medium- and long-term economic policy. The *Strategy* identifies areas affecting the achievement of its objectives, and one of the areas of SOR is "Energy". In each of SOR areas, directions of intervention were distinguished, followed by strategic projects and complementary activities. The provisions included in SOR in the area of "Energy" have been reflected and detailed in the *Energy Policy of Poland until 2040*.

Below is a list of strategic projects by intervention area. The adopted designations refer to the consecutive number of the intervention area, while the number in brackets is the consecutive number within the intervention area. This was used to designate them in PEP2040.

<b>Intervention area</b>	<b>Name and designation of SOR strategic project</b>	<b>Placement in PEP2040</b>
<b>1. Improvement of national energy security</b>	SP.1(1) Implementation of the capacity market SP.1(2) Polish Nuclear Power Programme SP.1(3) Gas hub	Specific Objective 2 Specific Objective 5 Specific Objective 4
<b>2. Improvement of energy efficiency</b>	SP.2(1) Programme for the construction of a smart grid in Poland	Specific Objective 2
<b>3. Technology development</b>	SP.3(1) Electromobility Development Programme SP.3(2) Development and use of geothermal potential in Poland SP.3(3) Distributed power generation SP.3(4) Use of hydropower potential SP.3(5) Innovative methods of hydrocarbon exploration and extraction (closed project)	Specific Objective 4 Specific Objective 6  Specific Objective 6 Specific Objective 6 -
<b>4. Restructuring of the hard coal mining sector</b>	PS.4(1) Restructuring of the hard coal mining sector	Specific Objective 1

Below are PEP2040 strategic projects, which consist of SOR projects and new projects. Some implementation dates included in SOR have been updated

<b>Specific Objective</b>	<b>Designation and name of PEP2040 strategic project</b>	<b>Designation of SOR project</b>	<b>Implementation time</b>	<b>Responsible entities</b>
1. Optimal use of own energy resources	SP.1 Transition of coal regions	development of SP.4(1)	2021 - drawing up a plan; implementation	MFiPR, MAP, MKiŚ,

			according to plan	
2. Expansion of generation and grid infrastructure	SP.2A. Capacity market	SP.1(1)	2021 – implementation, 2023 – decision on continuation	MKiŚ, TSOe
	SP.2B. Construction of a smart grid	SP.2(1)	2023 – establishment of the OIRE 2028 – installation of meters in households	MKiŚ, MC, distribution companies
3. Diversification of supply and development of network infrastructure for natural gas, crude oil and liquid fuels	SP.3A. Construction of the Baltic Pipe	<i>outside SOR</i>	2022	TSOg
	SP.3B. Construction of Line 2 of the Pomeranian Pipeline	<i>outside SOR</i>	2023	PERN S.A.
4. Development of energy markets	PS.4A. Implementation of the Action Plan for achieving the goal of 70% cross-border transmission capacity	<i>outside SOR</i>	2025	TSOe
	PS.4B. Gas hub	SP.1(3)	2023	MKiŚ, TSOg, DSOg, SSOg, POLPX
	PS.4C. Electromobility development programme	SP.3(1)	2025	
5. Implementation of nuclear power	PS.5. Polish Nuclear Power Programme	SP.1(2)	implementation – the whole perspective of PEP2040	MKiŚ, investor
6. Development of renewable energy sources	PS.6. Implementation of offshore wind energy	<i>outside SOR</i>	2025	MKiŚ
7. Development of district heating and cogeneration	PS.7. Development of district heating	<i>outside SOR</i>	2030	MKiŚ
8. Improvement of energy efficiency	PS.8. Promoting energy efficiency improvement	<i>outside SOR</i>	the whole perspective of the document	MKiŚ, NFOŚiGW, WFOŚiGW

## 8. PEP2040 indicators

Below is a list of key indicators for the proper implementation of PEP2040, extended in relation to the list presented in SOR for the "Energy" area<sup>122</sup>.

Indicator name	Unit of measurement	Base value (2018)	Target value (2030)	Source
Share of coal in electricity generation	%	77	≤ 56	MKiŚ
Share of renewable energy sources in gross final energy consumption	%	11.3	23	Eurostat
Share of renewable energy sources in transport	%	5.6	14	MKiŚ
Average annual growth of RES in heating and cooling (compared to 2020)	%	14.5	+1.1 pp y/y	MKiŚ
Primary energy consumption (23% energy savings compared to PRIMES 2007 forecast)	Mtoe	101.1	≤ 91.3 (23% less than 118.6)	MKiŚ
CO2 emissions (30% reduction compared to 1990 levels)	Mt	300.5	≤ 241 <sup>123</sup> (30% less than 345)	MKiŚ
Percentage of communes with an energy planning document	%	23	100	MKiŚ
SAIDI	min./cons.	133	≤ 85 <sup>124</sup>	MKiŚ
Number of electric vehicle slow charging points	pcs	900	49000	MKiŚ
Number of electric vehicle fast charging points	pcs	300	11000	MKiŚ
Share of zero-emission vehicles in the purchase of new public transport fleet in cities with more than 100 thousand inhabitants	%	4	100 (target for 2025)	GUS/CEPIK/ MKiŚ
Share of zero-emission vehicles in the public transport fleet in cities with more than 100 thousand	%	2	100	GUS/CEPIK/ MKiŚ

<sup>122</sup> The SOR indicator "Number of locally energy sustainable areas" has been dropped due to the lack of definitions at EU level.

<sup>123</sup> Target determined according to data from the *National Inventory Report 2020*, MKiŚ. The CO<sub>2</sub> emission target including LULUCF for 2030 is more ambitious compared to the forecasts in Appendix 2 to PEP2040 and Appendix 2 to KPEiK.

<sup>124</sup> Value revised compared to SOR following additional assessment of viable options.

inhabitants				
Percentage of households equipped with remote reading meters	%	n/a	≥ 80 (80 in 2028)	MKiŚ
Share of households in cities using (individually) hard coal for space heating	%	24.7	0	MKiŚ/GUS
Percentage of households in villages using (individually) hard coal for space heating	%	88.4	0 (target for 2040)	MKiŚ/GUS
Number of households in cities connected to district heating network	-	5.3 million	+1.5 million	GUS
Number of end consumers for natural gas	-	7.2 million	+1.5 million (target for 2024)	GUS/MKiŚ
Number of energy sustainable areas at local level (energy clusters, energy cooperatives)	-	66 energy clusters (1st half of 2020)	300	MKiŚ
Number of renewable energy prosumers	-	190 thousand (1st half of 2020)	1 million	MKiŚ/ERO
Level of energy poverty	%	9.4	6	GUS

## 9. Related documents

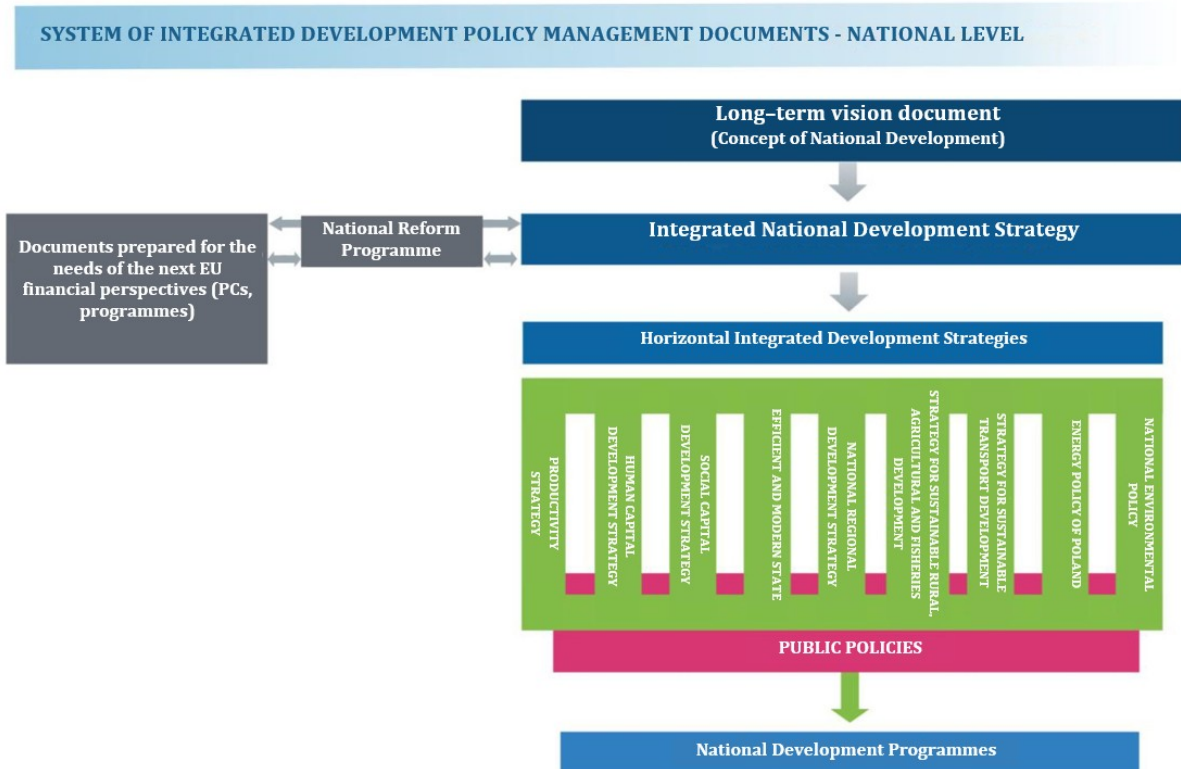
### Strategic documents, programmes and plans

- horizontal documents, including at EU and international level** – *National Energy and Climate Plan 2021-2030*, 2020,  
*Europe 2020 – A strategy for smart, sustainable and inclusive growth*, 2010.  
*European Commission Communication A Clean Planet for All - A European long-term strategic vision for a prosperous, modern, competitive and climate-neutral economy*, 2018.  
*We are transforming our world: the 2030 Agenda for Sustainable Development. 2030 Agenda for Sustainable Development, United Nations 2015.*  
*United Nations Framework Convention on Climate Change*, 1992.
- energy efficiency** – *National Energy Efficiency Action Plan for Poland 2017*, 2017.  
*National plan to increase the number of low energy buildings*, 2015.
- electromobility and alternative fuels** – *Electromobility Development Plan*, 2017.  
*National policy framework for alternative fuel infrastructure development*, ME 2017.
- emissions, air protection** – *Ecological Policy of the State 2030 – development strategy in the field of environment and water management*  
*National Air Protection Programme until 2020 (with an outlook to 2030)*  
*National Air Pollution Control Programme*
- nuclear power** – *Polish Nuclear Power Programme*, 2020.  
*National Plan for Radioactive Waste and Spent Fuel Management*, 2015.
- electricity** – *Community-wide 10-year network development plan*, ENTSO-E 2016.  
*Development plan for meeting current and future electricity demand for 2021-2030*, PSE 2020.  
*Quality regulation in 2018-2025 for Distribution System Operators (who unbundled, as of 1 July 2007)*, URE 2018.
- natural gas** – *Ten-Year Network Development Plan (TYNDP)*, ENTSO-G 2017.  
*National Ten-Year Network Development Plan 2020-2029*, GAZ-SYSTEM S.A. 2019.  
*Baltic Energy Market Interconnection Plan (BEMIP)*, 2009, updated 2015.
- renewable energy sources** – *National Renewable Energy Action Plan until 2020*, 2010.
- waste, waste incineration plants** – *National Waste Management Plan 2022*, 2016.
- crude oil and petroleum fuels** – *Polish Government policy for logistics infrastructure in the petroleum sector*, 2017.
- hard coal and lignite** – *Programme for the hard coal mining sector in Poland (2030 perspective)*, 2018.  
*Programme for the lignite mining sector in Poland (2030 perspective)*, 2018.
- strategies resulting from the** – *Strategy for Responsible Development until 2020 (with an outlook to 2030)* and integrated strategies (except PEP2040): (1) *National*

**national development management system**

*Ecological Policy 2030 - development strategy in the area of environment and water management, (2) Strategy of sustainable rural, agricultural and fishery development 2030, (3) Strategy of sustainable transport development till 2030, (4) Productivity strategy (draft), (5) National Strategy of Regional Development 2030, (6) "Efficient and modern state" Strategy (draft), (7) Social capital development strategy, (8) Human capital development strategy.*

Below is a diagram showing the shape of the integrated development policy management system at the national level.



**National Acts**

- Act of 10 April 1997 - Energy Law (Journal of Laws of 2020, Item 833, as amended)
- Act of 29 November 2000 Atomic Law (Journal of Laws of 2019, Item 1792, as amended)
- Act of 27 April 2001 Environmental Protection Law (Journal of Laws of 2020, Item 1219, as amended)
- Act of 25 August 2006 on bio-components and liquid biofuels (Journal of Laws of 2020, Item 1233, as amended)
- Act of 25 August 2006 on the monitoring and control system of fuel quality (Journal of Laws of 2021, Item 133)
- Act of 6 December 2006 on the principles of conducting development policy (Journal of Laws of 2019, Item 1295, as amended)
- Act of 16 February 2007 on oil, petroleum products and natural gas reserves and principles of proceeding in the event of a threat to the national security of supply and disturbances in the oil market (Journal of Laws of 2020, Item 411)
- Act of 26 April 2007 on crisis management (Journal of Laws of 2020, Item 1856)

Act of 3 October 2008 on the provision of information on the environment and its protection, public participation in environmental protection and environmental impact assessments (Journal of Laws of 2020, Item 283, as amended)

Act of 9 June 2011 Geological and Mining Law (Journal of laws of 2020, Item 1064, as amended)

Act of 29 June 2011 on preparation and implementation of investments in nuclear power facilities and accompanying investments (Journal of Laws of 2018, Item 1537, as amended)

Act of 14 December 2012 on waste (Journal of Laws of 2020, Item 797, as amended)

Act of 20 February 2015 on renewable energy sources (Journal of Laws of 2020, Item 261, as amended)

Act of 20 May 2016 on energy efficiency (Journal of Laws of 2020, Item 264, as amended)

Act of 12 June 2015 on the greenhouse gas emissions trading system (Journal of Laws of 2020, Item 136, as amended)

Act of 20 July 2017 - Water Law (Journal of Laws of 2020, Item 310, as amended)

Act of 8 December 2017 on the capacity market (Journal of Laws of 2020, Item 247, as amended)

Act of 11 January 2018 on electromobility and alternative fuels (Journal of Laws of 2021, Item 110)

Act of 5 July 2018 on the national cyber-security system (Journal of Laws of 2020, Item 1369)

Act of 14 December 2018 on the promotion of electricity from high-efficiency cogeneration (Journal of Laws of 2021, Item 144)

## **EU Regulations**

**Natural Gas Directive** - Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC (OJ EU L 211/94)

**Ecodesign Directive for energy-related products** - Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (OJ L 285, 31.10.2009).

**IED Directive** - Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (OJ EU L 334/17)

**MCP Directive** - Directive (EU) 2015/2193 of the European Parliament and of the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium-sized combustion plants (OJ EU L 313/1)

**NIS Directive** - Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 on measures for a high common level of security of networks and information systems within the Union (cyber security) (OJ EU L 194/1)

**Pollution Reduction Directive** - Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC

**Energy Efficiency Directive / EED** - Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 amending Directive 2012/27/EU on energy efficiency (OJ EU L 328/210) [from the "Clean Energy for All Europeans" package]

**Energy Efficiency of Buildings Directive** - Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the

energy performance of buildings and Directive 2012/27/EU on energy efficiency (OJ EU L 156/75) [from the "Clean Energy for All Europeans" package]

**Stocks Directive** - Directive (EU) 2009/119/EC of the European Parliament and of the Council of 14 September 2009 imposing an obligation on Member States to maintain minimum stocks of crude oil or petroleum products.

**RES Directive / RED II Directive** - Directive of the European Parliament and of the Council (EU) 2018/2001 of 11 December 2018 on the promotion of the use of energy from renewable sources (recast) (OJ EU L 328/82) [from the "Clean Energy for All Europeans" package]

**Market Directive / Directive on common rules for the internal market in electricity** - Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market in electricity and amending Directive 2012/27/EU [from the "Clean Energy for All Europeans" package]

**Regulation 715/2009** - Regulation (EC) No. 715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No. 1775/2005 (OJ EU L 211/36)

**ESR Regulation** - Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet their commitments under the Paris Agreement, and amending Regulation (EU) No. 525/2013 (OJ EU L 156/26)

**Energy Union Governance Regulation** - Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on governance of the energy union and climate action, amending Regulations 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EC and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulations (EU) No. 525/2013 of the European Parliament and of the Council [from the "Clean Energy for All Europeans" package]

**Market Regulation / Internal Energy Market Regulation** - Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market in electricity (OJ EU L 158/54) [from the "Clean Energy for All Europeans" package]

**SoS Regulation** - Regulation (EU) 2017/1938 of the European Parliament and of the Council of 25 October 2017 concerning measures to safeguard security of natural gas supply and repealing Regulation (EU) No. 994/2010 (OJ EU L 280/1)

**Regulation on the Agency for the Cooperation of Energy Regulators (ACER)** - Regulation (EU) 2019/942 of the European Parliament and of the Council of 5 June 2019 establishing an Agency for the Cooperation of Energy Regulators of the European Union (OJ EU L 158/22) [from the "Clean Energy for All Europeans" package]

**Risk Preparedness Regulation** - Regulation (EU) 2019/941 of the European Parliament and of the Council of 5 June 2019 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC (OJ EU L 158/1) [from the "Clean Energy for All Europeans" package]

## List of abbreviations

<b>BAT</b>	- best available techniques
<b>CNG</b>	- compressed natural gas
<b>DSOe</b>	- electricity distribution system operators
<b>DSOg</b>	- gas distribution system operators
<b>DSR</b>	- demand side response
<b>ENTSO-E</b>	- European Network of Transmission System Operators for Electricity
<b>ENTSO-G</b>	- European Network of Transmission System Operators for Gas
<b>EU</b>	- European Union
<b>EU ETS</b>	- European Union Emissions Trading System
<b>FBA</b>	- flow-based allocation
<b>FSRU</b>	- floating storage regasification unit
<b>GHG</b>	- greenhouse gases
<b>GUD</b>	- general distribution agreements
<b>GUS</b>	- Central Statistical Office
<b>HTR</b>	- high temperature reactor
<b>ICT</b>	- information and communication technology
<b>IOŚ-PIB</b>	- Institute of Environmental Protection – National Research Institute
<b>JWCD</b>	- centrally dispatched generating units (by TSOe)
<b>LNG</b>	- liquefied natural gas
<b>LV</b>	- low voltage power lines
<b>MAP</b>	- minister responsible for state assets and mineral deposits management
<b>MC</b>	- minister responsible for digitalisation
<b>MFiPR</b>	- minister responsible for regional development
<b>MI</b>	- minister responsible for transport
<b>MKiŚ</b>	- minister responsible for energy, for climate issues and for the environment
<b>MRiPS</b>	- minister responsible for social policy
<b>MRiRW</b>	- minister responsible for agriculture and rural development
<b>MRPiT</b>	- minister competent for construction, planning and spatial development and housing, for economy and for labour
<b>MSW</b>	- minister responsible for internal affairs
<b>MV</b>	- medium voltage power lines
<b>NIT</b>	- National Indicative Target (refers to RES share in transport)
<b>NP</b>	- nuclear power plant, nuclear power
<b>NPS</b>	- national power system
<b>OIRE</b>	- energy market information operator
<b>PIG-PIB</b>	- Polish Geological Institute – National Research Institute
<b>PPA</b>	- power purchase agreement
<b>PPEJ</b>	- <i>Polish Nuclear Power Programme</i>
<b>PRSIE</b>	- Government Plenipotentiary for Strategic Energy Infrastructure
<b>PURE</b>	- President of the Energy Regulatory Office
<b>RES</b>	- renewable energy sources
<b>SAIDI</b>	- System Average Interruption Duration Index
<b>SAIFI</b>	- System Average Interruption Frequency Index
<b>SOR</b>	- <i>Strategy for Responsible Development until 2020 (with an outlook to 2030)</i>
<b>SSO</b>	- natural gas storage system operator
<b>TSOe</b>	- power transmission system operator – Polskie Sieci Elektroenergetyczne S.A. (PSE S.A.)
<b>TSOg</b>	- gas transmission system operator – Operator Gazociągów Przesyłowych GAZ-SYSTEM S.A.
<b>UGS</b>	- underground gas storage