



Energy Industry in Poland

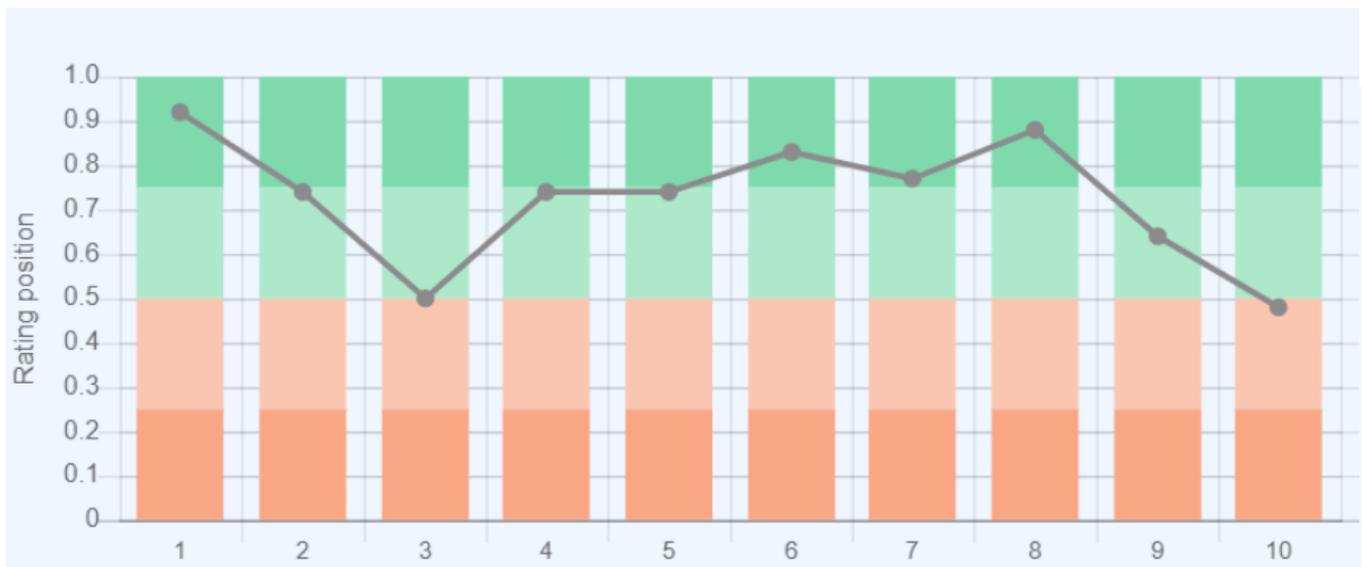


General State of the Economy

Poland, officially the Republic of Poland, is a country in Northern Europe. Its capital city is Warsaw. The country has borders with Germany, Belarus, Ukraine, Russia, Lithuania, Czechia and Slovakia. Poland has access to the Baltic Sea. Poland is the 71st largest country in the world and as of 2022 is home to more than 38 million people.

In terms of population density the country is also 152nd in the world [1,2].

Poland is a parliamentary republic and the official language is Polish. The administrative map of the country is divided into 16 provinces [3]. Poland has the 6th largest economy in the EU, reflected in Figure 1 [3]. For the majority of indices the positioning of the country is higher than the world average, in the top half of the graph, and



Sources:

1. GDP (purchasing power parity), 2020 est. / The World Factbook/Library/Central Intelligence Agency *228
2. GDP - per capita (PPP), 2020 / The World Factbook/Library/Central Intelligence Agency *229
3. Inflation rate (consumer prices), 2019 est. / The World Factbook/Library/Central Intelligence Agency *228
4. Charges for the use of intellectual property, receipts (BoP, current US\$), 2020 / International Monetary Fund, Balance of Payments Statistics Yearbook, and data files. / License: CC BY-4.0 *88
5. The Global Competitiveness Index 2019 / Rankings / Reports / World Economic Forum *141
6. High-technology exports (current US\$) 2019-2020 / United Nations, Comtrade database through the WITS platform / License: CCBY-4.0 / Data *134
7. 2021 Index of Economic Freedom / International Economies / The Heritage Foundation *178
8. Reserves of foreign exchange and gold, 2017 est. / The World Factbook / Library / Central Intelligence Agency *195
9. Annual average GDP growth in %, for the last 10 years (2011-2020) / World Bank national accounts data, and OECD National Accounts data files / License: CC BY-4.0 *206
10. Public debt (% of GDP), 2017 est. / The World Factbook / Library / Central Intelligence Agency *210 * Total number of countries participating in ranking

Figure 1. Economic indices of Poland

for 4 indices Poland is placed among the top quarter of the world's countries included in the rating.

Since the 1990s the country has experienced sustained GDP growth in purchasing power parity, both in general and per capita [4,5]. GDP at purchasing power parity increased from \$1.049 trillion in 2015 to \$1.223 trillion (19th place in the world) in 2020 [3]. The country's GDP at purchasing power parity per capita is lower (60th place in the world in 2020), but has also been demonstrating positive dynamics: from \$27,600 in 2015 to \$32,200 in 2020 [3].

The level of inflation changed from -0.6% in 2016 to 2.1% in 2019 placing the country 107th in the world (ranked by levels of inflation, low to high) [3]. By the level of market value of publicly traded shares in 2016, the country was 27th in the world.

According to The Global Competitiveness Report 2019 presented by the World Economic Forum, Poland was 37th (out of a total of 140 countries considered), behind Russia, but ahead of a large number of European countries, including Russia, Turkey and Romania. This rating measures the effectiveness of the use of the country's own resources for sustainable development. In addition to a number of economic indicators this index also takes

into account such variables as education, health, level of innovation, etc. In a list of 134 countries that exported high-tech products in 2019–2020, Poland was 23rd, slightly behind India. According to the Index of Economic Freedom 2021, which is based on freedom of business, freedom from government intervention and property protection, and freedom from corruption, the country was considered «moderately free», 41st, out of 178 countries. In terms of gold reserves and foreign exchange reserves Poland was 23rd in the world.

According to the indicator for the average GDP growth in percentage over the last 10 years, in 2020 the country was 74th out of 206 countries. In terms of public debt, calculated as a percentage of the country's GDP, Poland was ranked 100th out of 210 countries considered in 2017.

Despite the country's high level of GDP per capita, the latter two indices partially reflect a number of negative trends in the Polish economy, related to demographic problems, migration of young specialists to other EU countries, and problems with energy supply.

For more information on the economy of Poland see the attached link library by clicking [here](#).

Energy resources

Poland has no significant reserves of fossil resources (Table. 1). According to proven reserves of oil and natural gas, the country is ranked 69th and 53rd in the world, respectively [3]. According to data for 2018 in terms of tons of oil equivalent, proven coal reserves amounted to

99.5%, natural gas to 0.4%, and oil to 0.1% (Figure 5). The matrix of unconventional resources looks somewhat different: shale gas accounted for 91.8%; tight oil for 5.9%; coal mine methane utilization potential for 2.1%; and kerogen oil for 0.2% (Fig. 5). Poland's most valuable fossil fuel resource is coal; according to BP, its reserves at the end of 2020 amounted to 28,395 million tons.

Table 1. Fossil energy resources of Poland

Resource/ explanations	Crude Oil	Natural Gas	Coal	Shale Gas*	Coal mine methane	Tight Oil*	Oil Shale
Value	126	79.79	26 479	145.8	207-525	1.8	48
Unit	million bbl	Bcm	million tonnes	Tcf	Bcm	billion bbl	million bbl
Year	2018	2018	2018	2013	2018	2013	2008
Source	[3]	[3]	[6]	[7]	[6,9]	[7]	[8]

*unproved technically recoverable

In terms of proven reserves of this type of fossil fuel, Poland is second only to Germany in the European Union.

According to [3], at the beginning of 2018, oil reserves in Poland were estimated at 126 million barrels, and natu-

ral gas reserves at 79.79 bcm. According to BP's report [6], proven natural gas resources amounted to 0.1 trillion m³ as of the end of 2018. At the same time, according to the BP report [6], proven natural gas resources amounted to 0.1 trillion m³ as of the end of 2020.

The country has the second largest reserves of shale gas in Eastern Europe after Russia – 145.8 Tcf. Reserves of constrained oil totalled 1.8 billion barrels [7]. At the end of 2008, the reserves of kerogen oil were estimated at 48 million barrels [8].

According to Advanced Energy Technologies calculations, the potential for coal mine methane utilization,

according to a methodology based on methane emissions from coal mining [9] and its reserves [6], amounted to around 207-525 Bcm.

Poland, due to its geographical location, has a variety of reserves of renewable energy sources. A selection of basic indicators of this type of resource is presented in Table 2.

Table 2. Renewable energy resources of Poland

Resource/ explanations	Solar Potential (GHI)*	Wind Potential (50 m)*	Hydro energy Potential**	Bio Potential (agricultural area)	Bio Potential (forest area)	Municipal Solid Waste
Value	2.7-3.0	<6.0	5 000	46.9	30.9	329
Unit	kWh/m ² /day	m/s	GWh/year	% of land area	% of land area	kg/per capita
Year	2018	2018	2013	2016	2016	2018
Source	[11]	[12]	[10]	[13]	[14]	[15]

*for the majority of the territory of the country

**economically exploitable capability

The economically exploitable hydropower capability in Poland amounted to 5 000 GWh/year. For comparison, it is around 6 times less than the economically exploitable hydro potential of Austria [10].

The level of global horizontal radiation for the majority of the country is 2.7-3.0 kWh/m²/day; in the south and southeast of the country this can reach a maximum level of 3.0-3.2kWh/m²/day [11], which is comparable to similar indicators, for example, for Denmark, Southern Sweden, and Belgium.

The distribution of wind resources is as follows: for the majority of the country the wind speed does not exceed 6.0 m/s, but on the coast of the Baltic Sea, this figure may exceed 6.0 m/s at a height of 50 metres [12]. This offers good potential for the future development of wind energy in the power industry of Poland, which would allow wind energy to compete with the country's established renewable technologies – bio and hydropower.

According to data for 2018, 47.4% of the territory of the

country is occupied by agricultural land, showing a slight increase from 2016 [13]. According to data for 2020, 30.9% of the country's territory was forested, a proportion that hasn't changed much in recent years [14].

According to Eurostat, in terms of municipal waste generation, at 329 kg per capita in 2018 Poland was behind, for example, the Czech Republic – 351 kg per capita, and Slovenia – 486 kg per capita [15]. This resource is a valuable raw material for recycling or energy production, the technologies of which have reached a high level of development in Poland.

A detailed list of sites and special reports on Poland energy resources can be found [here](#).

Energy Balance

According to the BP Statistical Review of World Energy 2021, total primary energy consumption in Poland in 2020 was 4.01 Exajoules (557.1 in the world), about 42% of which was from coal, almost 32% from oil, 19.4% from natural gas, 6.7% from other renewables, and 0.5% from hydroenergy [6].

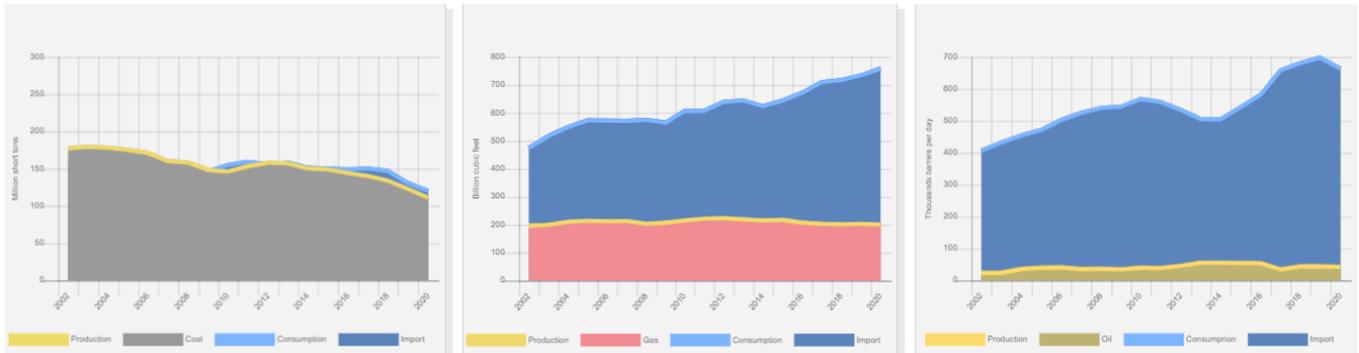
Using the data from [3,6] we calculated GDP per unit of primary energy use in Poland in 2020 at \$12.8, taking into account PPP in 2011 prices per unit of energy

expended (the equivalent of energy contained in one kg of oil equivalent/\$ PPP per kg of oil equivalent), which corresponds to the world average level of GDP energy efficiency.

Oil production increased insignificantly between 2002 and 2020 (Figure 2), and in 2020 amounted to 43 thousand barrels/day [16]. At the same time consumption grew, having undergone a slight decline between 2010 and 2014, before resuming its growth, and in 2020 amounted to 663 thousand barrels/day [16]. According to the BP survey, the level of oil consumption in Poland in

2020 was 660 thousand barrels/day [6]. In 2018, the main contribution to Total Primary Energy Production (TPES) in Poland – almost 60% – was provided by domestic coal production [17]. In 2017, oil imports to Poland were estimated at 493,100 barrels/day [3].

The production of natural gas in the country between 2002 and 2020 did not exceed the level of 203 Bcf; consumption has been increasing during this period and by 2020 amounted to 758 Bcf [16]. According to the BP Statistical Review of World Energy 2021 [6], gas consumption in the country in 2020 was 21.6 billion m³,



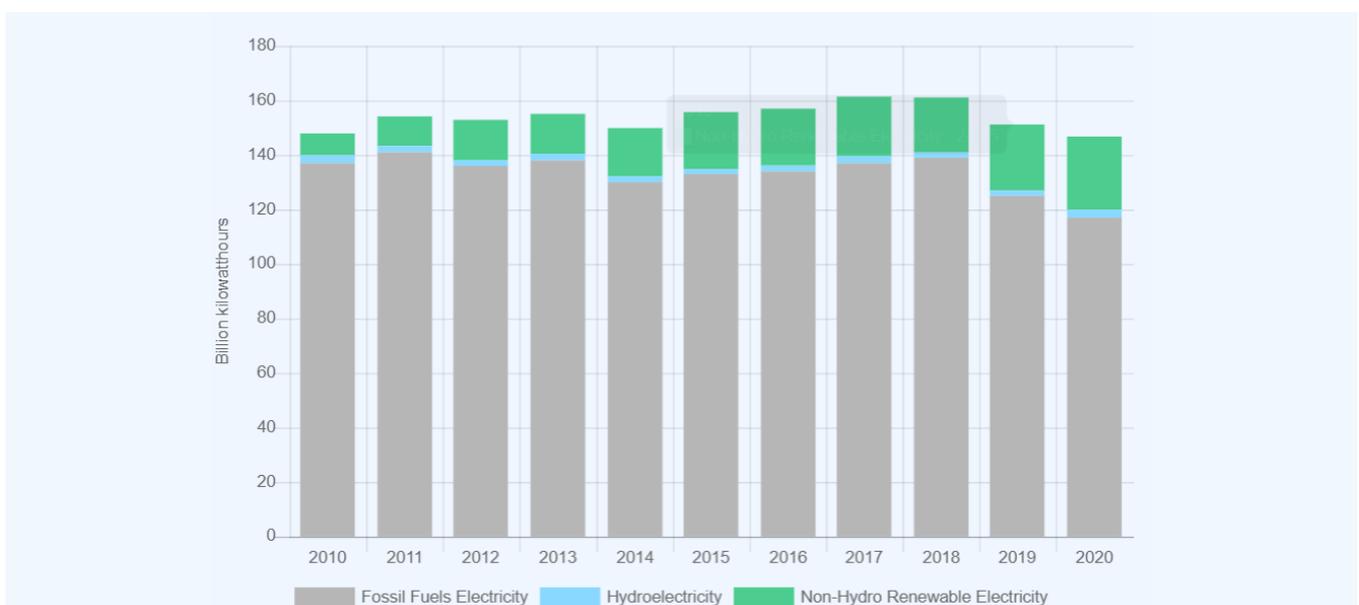
Source: U.S. Energy Information Administration (Dec 2021) / <https://www.eia.gov/>

Figure 2. The production and consumption of fossil fuels in Poland (coal – left, gas – in the center, oil – right)

while production was 3.9 billion m³. According to the International Energy Agency, the total final natural gas production in the country amounted to 3 423 ktoe in 2018 [17]. In 2017, Poland imported around 15.72 Bcm of natural gas [3]. Coal production in the country has been gradually decreasing since 2002, and in 2020 totalled 111 million short tons, against 177 million short tons in 2002 [16]. Consumption has remained practically unchanged, not exceeding the level of 160 million short tons. According to BP, in 2020 coal production amounted

to 1.68 Exajoules, and consumption to 1.67 Exajoules [6].

Poland mainly uses fossil fuels for the production of electricity, however, the share of renewable energy sources has been increasing and consequentially the share of fossil fuels has been declining (Fig. 3.), as there have been no significant changes in the total electricity production.



Sources: U.S. Energy Information Administration (Dec 2021) / <https://www.eia.gov/>

Figure 3. Electricity production in Poland

In 2020, according to the U.S. Energy Information Administration, the country produced 146.22 TWh of electricity, where fossil fuels accounted for 79.8%, renewables -

18.4%, hydropower - 1.8% (Fig.6).

Poland's position in the comparative diagram of energy index is shown in Figure 4.



Sources:

1. Crude oil proved reserves, 2021 / International Energy Statistic/Geography / U.S. Energy Information Administration (Nov 2021)*98
 2. Natural gas proved reserves 2021 / International Energy Statistic / Geography / U.S. Energy Information Administration (Nov 2021) *99
 3. Total recoverable coal reserves 2019 / International Energy Statistic / Geography / U.S. Energy Information Administration (Nov 2021) *81
 4. Combination production-consumption for Crude oil 2018 / International Energy Statistic / Geography / U.S. Energy Information Administration (Nov 2021) *219
 5. Combination production-consumption for Natural gas 2019 / International Energy Statistic / Geography / U.S. Energy Information Administration (Nov 2021) *123
 6. Combination production-consumption for Coal 2019 / International Energy Statistic / Geography / U.S. Energy Information Administration (Nov 2021) *128
 7. Electricity – from other renewable sources (% of total installed capacity), 2017 est. / The World Factbook / Library / Central Intelligence Agency *170
 8. GDP per unit of energy use (PPP per unit of oil equivalent), 2020 *66
 - Primary energy consumption - BP Statistical Review of World Energy 2021/BP;GDP (purchasing power parity) - The World Factbook/Library/Central Intelligence Agency
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 10. The Global Energy Architecture Performance Index Report (EAPI) 2017 / Rankings / Reports / World Economic Forum
 11. Electric power consumption (kWh per capita), 2016 *217
 - Electricity Consumption - The World Factbook / Library / Central Intelligence Agency; Population - United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019, custom data acquired via website. Retrieved 15 November 2021
 12. Combination of electricity production-consumption (kWh)/The World Factbook/Library/Central Intelligence Agency *216
- * Total number of countries participating in ranking

Figure 4. Energy indices of Poland

Due to the absence of significant oil and gas reserves, Poland is at the bottom of the list of countries in terms of production/consumption of oil and gas, ranging from high to low values. However, in terms of coal reserves and the production/consumption ratio, the positioning of the country looks more convincing.

In a rating from 2017 listing countries by their level of production of electricity from renewable sources (excluding hydropower), Poland was 43rd out of 170 countries selected for consideration, ahead of France.

In 2020 Poland was 23rd out of 66 countries ranked by the ratio of GDP per unit of energy use in 2020, while in

terms of energy consumption per capita Poland is 33rd in the world, ahead of Italy, China and the United Kingdom. In terms of electricity consumption per capita, the country is 72nd in the world. For the indicator of combined electricity production-consumption, Poland is 42nd in the ranked list of 216 countries.

More information about the energy balance of Poland can be found in the documents from our reference library [here](#).

Energy Infrastructure

A territorial map showing the distribution of the largest infrastructure projects of the fossil fuel sector and electricity in Poland is shown in Figure 5.

In the total potential of fossil energy resources, coal plays the predominant role – 99.5%; natural gas accounts for 0.4%, oil for 0.1% (Figure 5). Belchatow is the largest coal mine and has a production level of 50 million tons per year [18]. Coal is exported via

an export terminal in Gdynia with a capacity of 1.3 million tons [19], and a test project exploring underground coal gasification is taking place at the Barbara (Mikolów) Central Mining Institute UCG Test Project (Fig.5).

One of the leading gas fields is Lubiatoł-Miedzychod-Grotow (LMG), PGNIG Natural Gas Field, capable of producing an estimated 100 million m³ a year [20]. LNG is imported into the country via the Świnoujście LNG Import Terminal (3.6 mtpa) [21]. The gas processing infra-

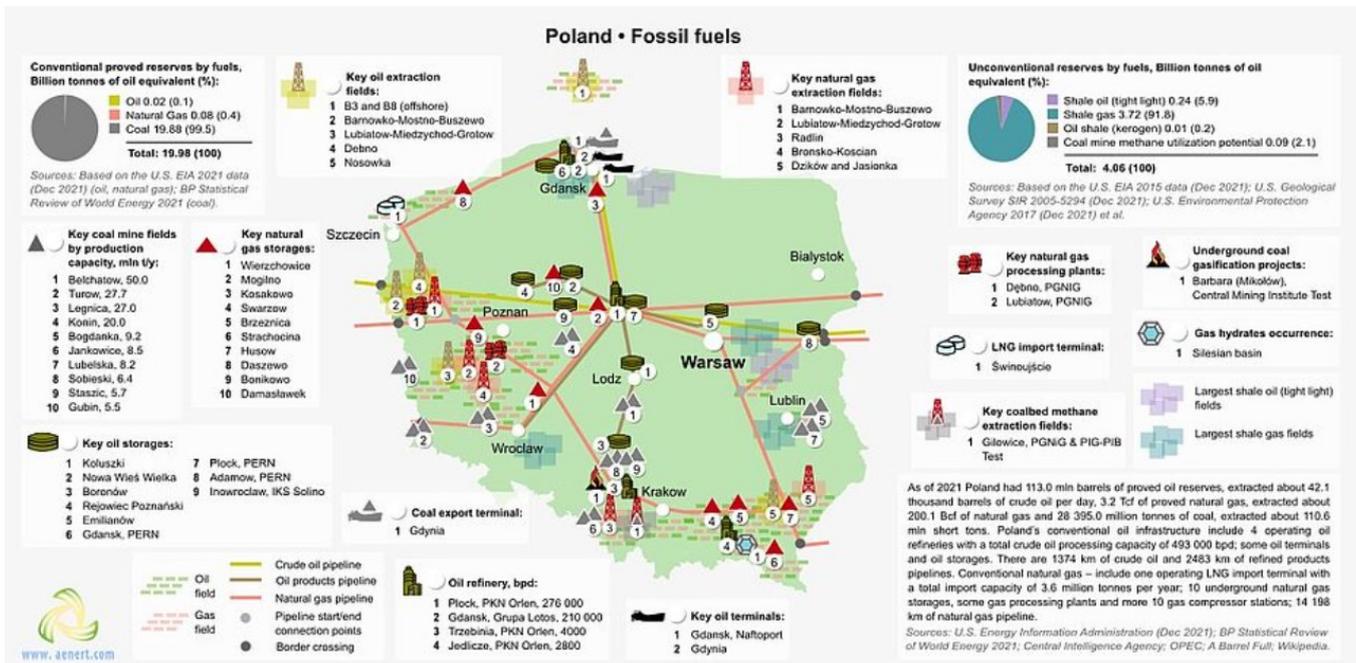


Figure 5. Basic infrastructure facilities of the fossil fuel sector in Poland

structure is represented by two power plants owned by PGNIG; the largest is Dębno Natural Gas Processing Plant with an installed capacity of 45 MMscfd [22]. Gas is transported through a network of pipelines with a total length of 14,198 km (Figure 5), and is stored in a large number of underground storage facilities. Poland is one of the participants in the search and development of gas hydrate occurrences, which have been found, for example, in the southern Silesian basin (Fig.5).

The offshore B3 and B8 are the leading oil fields with production levels at 145,600 tonnes/year and 250,000 tonnes/year, respectively [23]. Oil refining is carried out at four refineries; the largest Plock Statoil Oil Refinery has an installed capacity of 276,000 bpd [24] (Fig.5). The import of oil and petroleum products is carried out via two offshore oil terminals, and there are 9 large oil storage facilities. The transportation of oil and petroleum products is carried out via pipelines with a total length of 1,374 km and 2,483 km (Fig. 5).

Poland is one of major importers of oil and gas from Russia via transit pipelines that terminate in Germany. In recent years Poland has built one of the first LNG terminals in the Baltic region, with a capacity of 5 billion cubic metres per year. Gas supplies started in 2017; the coun-

try also receives LNG from the United States. With an increase in the supply of liquefied gas to the region, competition may arise from a similar terminal in Klaipėda (Lithuania) and a terminal planned for construction in Germany, as well as from the second stage of the Nord Stream pipeline from Russia. Poland has repeatedly stated the possible cessation of gas imports from Russia after the expiration of existing contracts in 2022. However, this would only be possible with the additional implementation of the Baltic Pipe pipeline project from Norway with a volume of at least 10 billion cubic metres per year, since the existing capacity of the Polish LNG terminals, even after the planned expansion, cannot fulfil future import demands. The main oil shale fields are located in the north of the country and near the capital; shale gas fields have been discovered in the region of Wrocław, Warsaw and Gdansk (Fig. 5). In 2012-2014 the development of Polish fields using hydraulic fracturing resulted in many companies, including Exxon Mobil and Chevron, being refused licenses and exiting from their projects. Some analysts attribute this to a considerable depth of raw materials, others point to increased soil viscosity or significantly overestimated preliminary estimates of these reserves.

However, Poland has failed to recreate the industrial shale boom that has taken place in the United States. The map showing the territorial distribution of Poland's largest infrastructure facilities for electricity generation is presented in Figure 6.

According to the U.S. Energy Information Administration, the share of fossil fuels in energy production in Poland in 2017 was 85% (Fig.6).

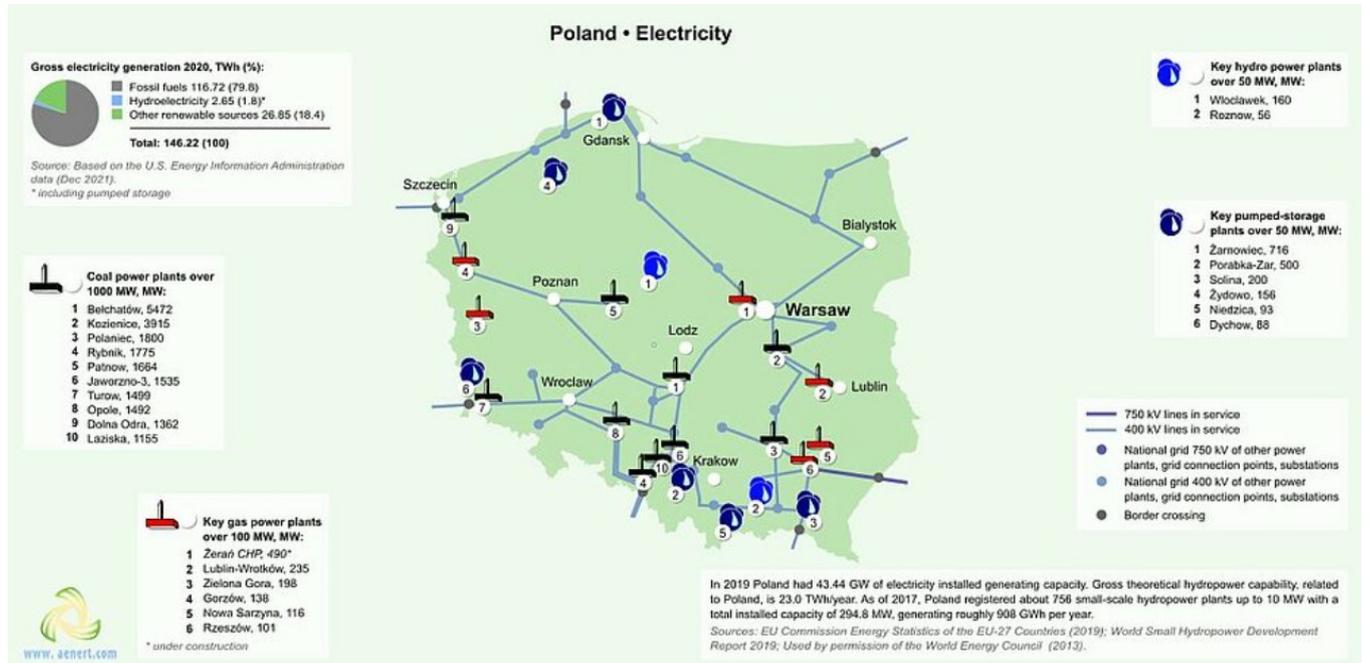


Figure 6. Electricity production in Poland

The country has a significant number of stations for the production of electricity from hydrocarbons, including six gas and ten coal power plants with a capacity of over 100 MW (Fig.6).

The largest power plants in Poland are: Żerań CHP gas power plant which is a capacity of 490 MW [25]; and the Bełchatów coal complex with an installed capacity of 5,472 MW, which is the largest thermal power plant in Europe [26].

The share of hydropower in electricity production was 1,6%; this sector is represented by both pumped-storage power plants and large and small hydropower plants (Fig.6). The largest pumped storage power plant is Żarnowiec, with an installed capacity of 716 MW, and the largest hydropower station is Włocławek, with a capacity of 160.2 MW [27,28]. In 2017, Poland registered 766 hydropower plants, out of which 756 are considered as small-scale hydropower plants (up to 10 MW), according to [29]. The total installed capacity of hydropower plants in Poland was 988.4 MW, of which 294.8 MW accounted for small hydropower plants.

The map of the territorial distribution of the largest infrastructure facilities of renewable energy in Poland is presented in Figure 7.

As noted above, renewable energy (excluding hydroenergy) in 2020 generated 26.8 TWh (Fig.7).

In zones of high wind activity there are 12 large wind parks, with a capacity of more than 60 MWth each. In 2021 Poland registered about 328 wind farms, with a total capacity of 7 306 MW [30,31]; the largest is Margonin Wind Farm, with a capacity of 120 MW [31].

As noted above, the level of global horizontal solar irradiation in some areas of the country can reach 3.2 kWh/m²[11]. Consequently, a number of solar plants have been built on this territory. The largest photovoltaic solar station is Czernikowo, with an installed capacity of 3.8 MW [32], and the leading Solar District Heating plant is the Łódź SDH plant capable of generating 5.1 MWth of thermal energy [33].

The share of bioenergy in electricity production was 30.3% (Fig.7). There are biogas enterprises in the country as well as enterprises for processing municipal waste, production of biodiesel, bioethanol, pellets, etc. (Fig.7). Poland's largest enterprises for the production of second-generation biogas and bioethanol are: Katowice, Skotan with a capacity of 250 000 tonnes/year; and Goswinowice, Bioagra with a capacity of 175 mln litres/year [34,35].

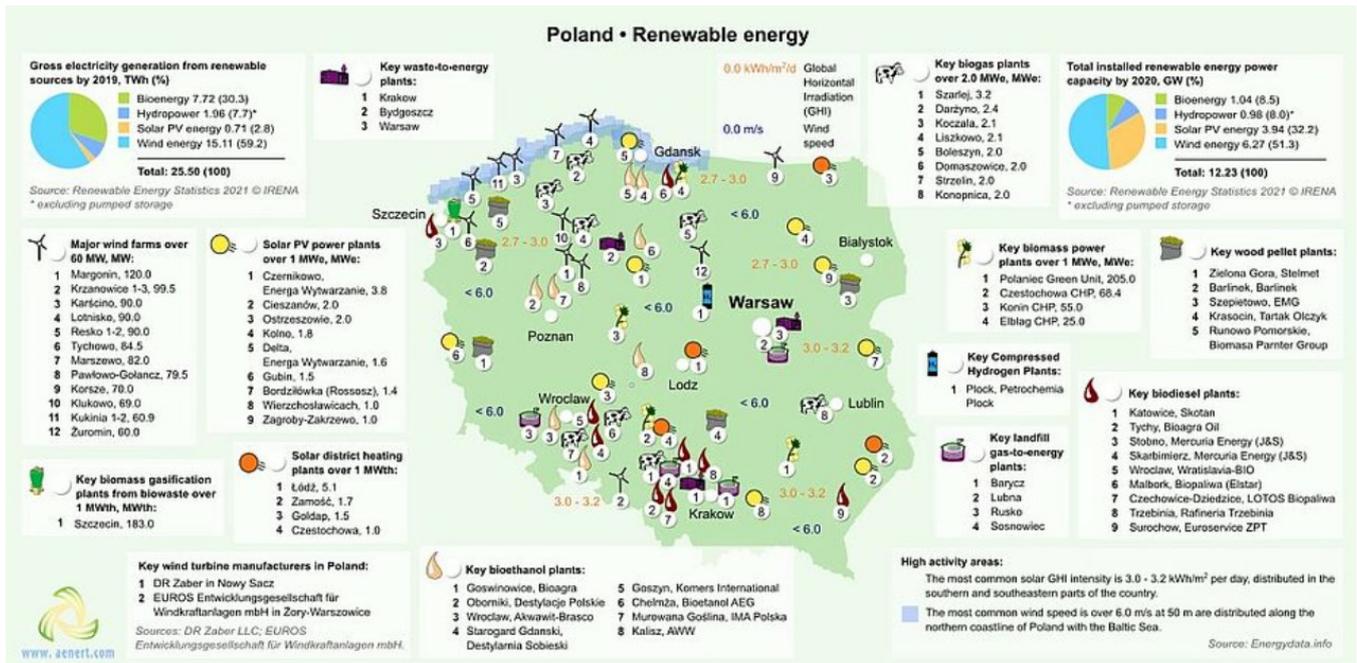


Figure 7. Renewable energy in Poland

One of the main biogas production enterprises in the country is Szarlej Biogas Plant with an installed capacity of 3.2 MW, which uses manure, maize and other waste as raw materials [36].

Among other bioenergy enterprises, Poland has one of the world's largest biofuel power plants: the Polaniec Green Unit Biomass power plant, which has an installed capacity of 205.0 MWe [37]; and Szczecin Biomass Gasification Plant, with an installed capacity of 183.0 MWh [38]. The largest enterprise in Poland using this technology, Zielona Gora, Stelmet Wood Pellet Plant, which can produce about 144,000 tons of pellets annually [39]. The leader in the generation of electricity from municipal

waste is located in Krakow and can process about 220,000 tons annually [40].

Poland also develops hydrogen energy, which can be used as an energy source for vehicles. One of the largest enterprises producing hydrogen is Plock, Petrochemia Plock Compressed Hydrogen Plant, which has a capacity of 4 583 Nm³/hr [41].

For current information on the development of energy in the country see [here](#). More information about Polish energy infrastructure is also available [here](#).

Education and Innovation

The set of indices reflecting the position of Poland among other countries in the field of education and innovation can be seen in Figure 8.

According to the indices presented, Poland demonstrates a high level of innovation activity and education – all indices are above the world average, and some of them place considerably higher.

Poland is 40th out of 132 countries considered in the ranking of countries of the Global Innovation Index 2021 (see diagram), ahead of Turkey and Croatia.

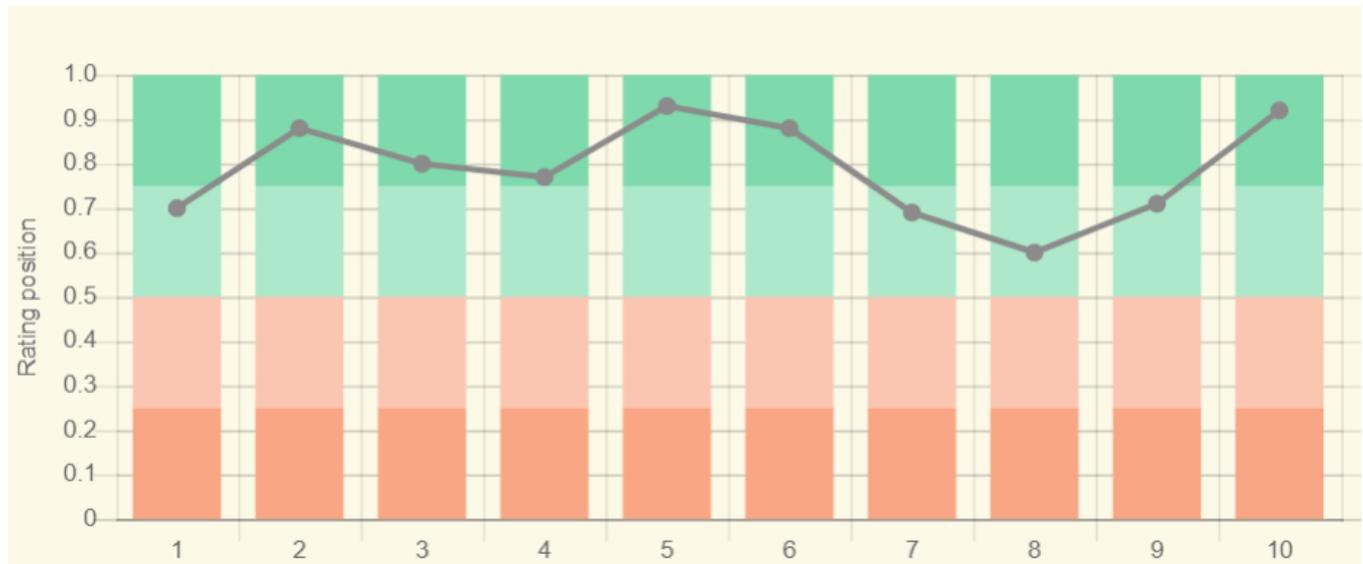
According to the number of patents granted to Polish nationals, both domestically and abroad, the country ranks 22nd in the world, behind a number of European countries, but nevertheless higher than the world average.

Similarly, by the number of valid patents, the country is above the world average – 22nd place, indicating the country's favourable conditions for innovation. In terms of government expenditure on education as a percentage of the country's GDP, the country demonstrates a high result – 71st out of 177 countries selected for consideration, which has contributed to the fact that 19 Polish universities entering the QS University Rating.

Poland is very well positioned when considering the number of publications of specialists in scientific and technological journals and patent activities. The country is 17th out of 240 participating countries in the Scimago ranking, and in Scientific and Technical Journal Activities it is ranked 16th out of 197 countries. The country is also among the leaders in the region in terms of the number of Internet users and is 35th in terms of government ex-

penditure of research and development. Polish universities, such as Warsaw University of Technology, the University of Warsaw, and Gdansk University of Technology train specialists in various fields of energy, including Nuclear Energy and Nuclear Chemistry, Applied Petroleum Geosciences, Environmental Engineering, etc. In the field of synthetic fuel production the main research institutes are the Central Mining Institute, Łódź Uni-

versity of Technology, and the Silesian University of Technology. In the field of unconventional oil research is conducted by AGH University of Science and Technology and the Polish Geological Institute. Another important area is coalbed methane.



Sources:

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- * Total number of countries participating in ranking

Figure 8. The indices of education and innovation in Poland

The leaders in patenting are Instytut Inżynierii Chemicznej Polskiej Akademii Nauk, Katalizator Sp zoo, and the leaders by the number of publications are AGH University of Science and Technology and the Central Mining Institute. In the field of hydrocarbon production from reservoirs with low permeability, the leading patent holders are Baltic Ceramics SA, and AGH University of Science and Technology and Warsaw University of Technology conduct research in this field.

The leading patent holders in the field of bioenergy are Politechnika Lodzka, Politechnika Lubelska. Research is conducted by the Silesian University of Technology, the University of Warmia, and Mazury in Olsztyn.

A large number of companies patent technical solutions in the field of energy production from renewable sources. Notable enterprises in the field of solar energy include Akademia Gorniczo-Hutnicza Im. Stanislawia Staszica w Krakowie. Leading research organizations in this field are

Warsaw University of Technology and Cracow University of Technology.

Politechnika Slaska, Vistal Infrastructure Sp. z o.o., lead in the number of patents in the field of wind power, and the Institute of Fluid Flow Machinery, the Polish Academy of Sciences, Warsaw University of Technology, and AGH University of Science and Technology conduct research in the field.

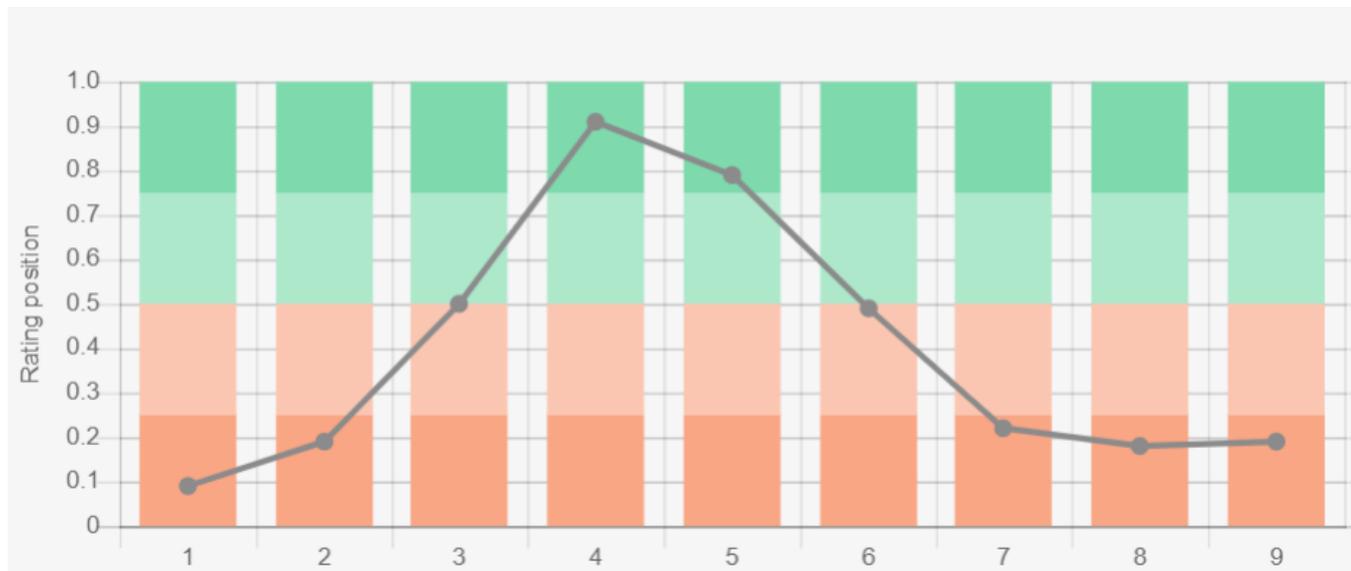
Additional information about education in the country can be obtained [here](#), and the list of research institutes [here](#).

Ecology and Environment Protection

The diagram of environmental indices presented in Figure 9 to some extent reflects the ecological situation in the country.

The country demonstrates a relatively high level of CO₂ emissions, both in general and per capita. It is also necessary to note the high level of methane emissions in

the country. Poland is 56th in the Climate Change Performance Index (CCPI) 2022, which includes 60 countries responsible for more than 90% of global energy-related CO₂ emissions. The ranking compilers note that Poland is not actively taking measures aimed at reducing its share of harmful emissions.



Sources:

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 2. CO₂ per capita emission 2020/European Commission/Joint Research Centre (JRC) / Emission Database for Global Atmospheric Research (EDGAR) *208
 3. Forest area 2020 (% of land area) / The Global Forest Resources Assessment 2020 / Food and Agriculture Organization of the United Nations *234
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 5. The Environmental Performance Index (EPI) 2020 / Rankings / Yale Center for Environmental Law & Policy / Yale University *180
 6. Annual freshwater withdrawals (m³ per capita), 2017 *179
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- * Total number of countries participating in ranking

In terms of forest area as a percentage of the country, Poland was 117th in 2020 out of 234 countries. However, the trend associated with its change from 2010-2020 looks positive and according to this indicator the country is 21st in the world. The country is very well positioned in the Environmental Performance Index (EPI) 2020, which focuses primarily on the environmental activities of national governments, aimed at reducing the negative impact of the environment, and rational use of natural resources. In this ranking, the country is 37th out of 180 participating countries, behind a number of European countries.

However, according to the Environmental Vulnerability Index, which is based on years of observations and 50

indicators that include, for example, changing climatic characteristics or the quality of water resources, waste volumes, oil spills and other hazardous substances, etc. Poland is 188th out of 234 countries, and is characterized as “vulnerable”. Finally, it is worth mentioning that according to the Ecological Footprint Atlas rating Poland is among a number of ecological debtors.

For more information on the energy complex of Poland see the attached link library by clicking [here](#).

References

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