



## Research paper

# Analysis of the “Adaptation strategy for sectors and areas vulnerable to climate change to 2020 with an outlook to 2030 (SPA 2020)”

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**Abstract:** Poland performs very badly in all kinds of rankings related to environmental protection and usually ranks last compared to other EU countries. Several programmes and strategies are currently being implemented to improve this situation. These include both national and local government documents. The author presents the most important of these and analyses both their provisions and the effectiveness of their implementation. One of the key aspects of adaptation to climate change is Poland's energy transition from coal-based power generation to renewable energy sources. Unfortunately, over the past few years, legislators and regulators have significantly impeded this process, particularly with regard to photovoltaic energy and wind energy, as well as biogas plants. A significant problem is also the limitation of funding for this transformation, due to the blocking by the EU institutions of the disbursement of funds from the National Reconstruction Programme. Without the unblocking of these funds and the effective implementation of existing programmes and strategies, Poland will remain one of the most polluted EU countries with an archaic energy mix.

**Keywords:** sustainable development, green strategies, SPA 2020, RES

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## 1. Introduction

In January 2021, the European economy saw a fundamental shift in economic priorities. The current focus is on energy sovereignty, improving security, basic social consumption and reducing greenhouse gas emissions into the atmosphere.

The question therefore arises as to whether the investments to prevent climate change, which have been a priority for the European Union in recent years as a result of the need to implement the outcomes and conclusions of the programme of the Nairobi Forum on Impacts, Vulnerability and Adaptation to Climate Change under the auspices of the United Nations, in which 190 countries from around the world participated, can be continued in parallel. The EU Commission published on 1.4.2009. The EU Commission published on 1.4.2009 a White Paper on Climate Change Action and in April 2013 published the EU Climate Change Adaptation Strategy (COM (2013) 216. The SPA until 2020 developed by Poland refers both to the 2009 White Paper. EU as well as to the “Strategy...” of 2013.

Climate change scenarios for Poland until 2030 assume that extreme weather phenomena, i.e. hurricanes, tornadoes, heavy rainfall, hailstorms, alternating with rainwater storms, floods, waterlogging, landslides, as well as heat waves and droughts, will pose the greatest threat to our country (its economy and society). However, they omitted pollution and contamination of rivers, fires at illegal, wild and unattended landfills and hazardous waste sites.

In this context, the author analysed the economic activities in Poland over the last 10 years and the legal acts issued, indicating positive measures and those that delay the country's climate change adaptation programme.

The immediate driver for addressing the issue is the programme of the “Adaptation Strategy for Sectors and Areas Vulnerable to Climate Change to 2020 with an Outlook to 2030 (SPA 2020)” [1] adopted on 4 July 2019.

The results of scientific research worldwide clearly indicate that the phenomena resulting from climate change pose a serious threat to the economic and social development of most countries worldwide.

Adaptation measures should reduce the vulnerability of individual countries to the drivers of economic efficiency and environmental health across the planet. It should be strongly emphasised here that the costs of such adaptation will amount (for developing countries alone) to as much as EUR 100 billion, based on data from the European Environment Agency (EEA). However, if action is not taken immediately, according to EEA analysts, this figure could approach EUR 200 billion per month [2].

With these considerations in mind, the Polish government developed SPA 2020 (with an outlook to 2030).

The energy transition towards “green energy” is also of paramount economic importance as the reduced need for fossil raw materials reduces production costs. Poland's declared aim of achieving only a 21% share of RES by 2030 [3] in gross final energy consumption will deprive us of the possibility to produce industrial goods at competitive prices, e.g. in relation to the Federal Republic of Germany, where the law stipulates that by 2030. 80% of the energy produced will come from RES [4].

As a course of action, it is necessary for Poland to adopt a series of laws that will enable the development of RES through the involvement of the funds of direct energy users and for the energy transformation at the plant and utility level to make optimal use of funds from the National Recovery and Resilience Plan (NRP).

What the implementation of the Clean Air Priority Programme looks like can be read in the NIK report KSI.430.008.2021 with reg. no. 199/2021/9/21/053/KSI [5] published on 30.06.2022 by the Department of Environment and approved by the President of the Supreme Audit Office on the same date.

At the beginning of the third decade of the 21st century, the most important task facing humanity is to protect the environment and combat climate change, which poses a serious threat to the existence of people on earth. Scientists from all major countries are trying to find and provide ways of limiting the increase in temperature on our planet, the increase in which is having catastrophic consequences in the form of droughts, fires, torrential rain, landslides, floods, tornadoes, hailstorms, tornadoes, hurricanes, typhoons, monsoons, even in areas where they did not previously occur, and where they did occur, they have now taken on catastrophic forms. The pollution of the atmosphere by CO<sub>2</sub> is increasing year by year, rivers are turning into sewage, and some of them (like lakes and ponds) are even drying up. The planet is starting to resemble one big dump. This is particularly true of South America, Central America, Africa and mainland Asia, as well as many islands in the Pacific and the oceans themselves, which receive millions of tonnes of plastic a year and millions of tonnes of petroleum products. In the Pacific, a huge island of plastic waste has been created, with an area approximately five times the size of Poland.

The seas and oceans are turning into one big rubbish dump. Plastic micronutrients are already present in the flesh of almost all species of oceanic fish. When people consume fish meat, many times they do not even realise that plastic in microbeads is entering their digestive tracts.

Environmentalists' calls to reduce meat consumption or even replace it with plant proteins bring a smile to their lips or even pity. For the most part, people do not realise that livestock production or even meat and sausages release hundreds of millions of tonnes of CO<sub>2</sub> into the atmosphere, causing an increase in the Earth's greenhouse effect. Not to mention that much of it is contaminated by the ash escaping from the chimneys of factories, steel mills, power plants, coke plants, waste incinerators and the thousands of fires that affect and destroy entire regions of the world. The future is artificial meat where 90% less water and 85% less energy is used to produce it.

The scary thing, however, is that all the promises made by politicians at congresses, environmental conferences around the world do not translate into actual action outside of a few EU countries, as well as Switzerland, Canada, Norway, Japan, South Korea, Australia, New Zealand or England.

Also, many scientists, e.g. in the United States of America, believe that the current situation on Earth is anomalies occurring every few hundred years and that nothing needs to be done about it, because today we only have a situation that will normalise itself in a few decades. Figure 1 illustrates the perception of this by US citizens, broken down into Democrats, independents and Republicans.

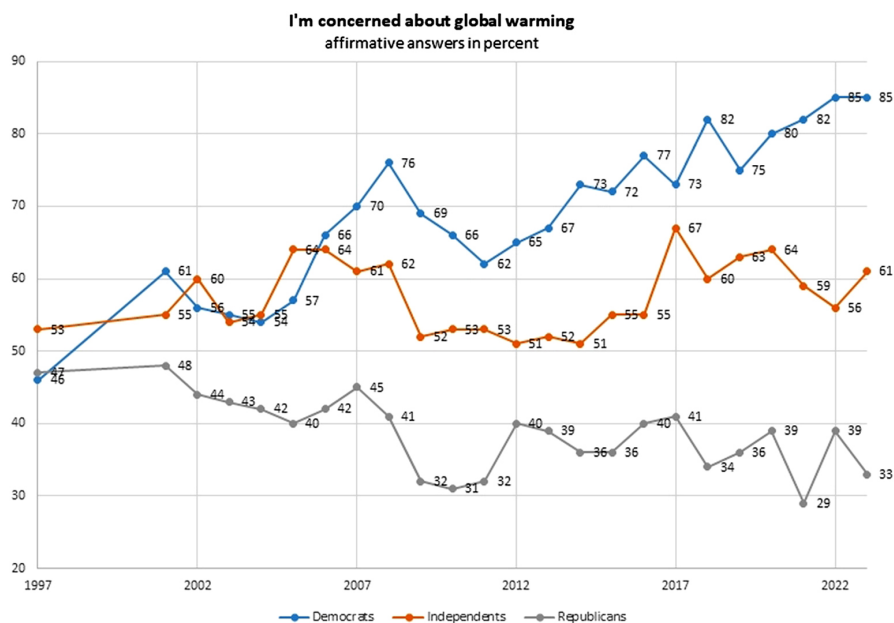


Fig. 1. Survey concerning global warming conducted by GALLUP [6]

On the contrary, perceptions of the phenomenon of climate change in Poland are shown in Fig. 2.

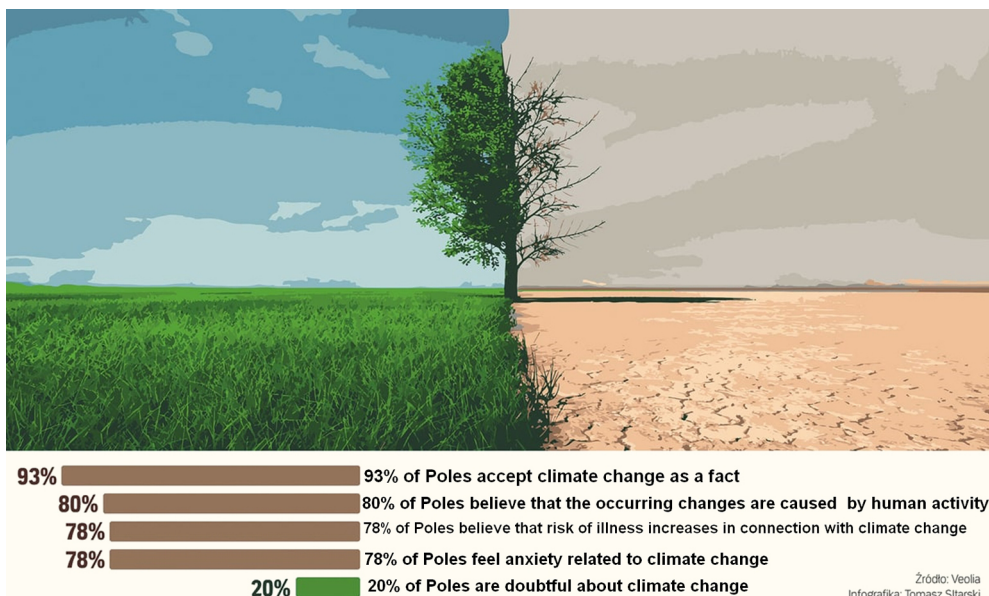


Fig. 2. Barometer of ecological transformation in Poland [7]

Against the background of a brief description of climate change and the extremely harmful human impact on the environment, the author succinctly presented (based on data from reports and publications included in the bibliography) the situation in Poland and stated what problems need to be solved in this respect.

First, however, it is necessary to perform the analysis and see where Poland currently stands in the introduction of SPA 2020.

Reading the SPA until 2020 (for 2021–2030), one has to conclude that it needs to be updated immediately, with new reliable data and timetables, and calculations of the resources it will consume, as well as the prioritisation of the spending of these resources.

Despite the provisions in the SPA to 2020 to address the 2070 perspective, little has been done in this regard.

## **2. Status of implementation of SPA 2020 with an outlook to 2030 as at 1 July 2021**

Over 11 years, it was planned to improve the energy efficiency of more than 3 million buildings and replace 3 million heat sources. In October 2021, after three years of implementation of the Priority Programme Clean Air (PPCP), the number of insulated buildings was less than 73,000 (2.4%), and more than 66,000 old-generation boilers (2.2%) were replaced with low-emission ones. By that time, as the audit carried out by the Supreme Audit Office (NIK) showed, with a budget of PLN 103 billion, contracts had been signed for only PLN 4.2 billion (about 4%). In the opinion of the NIK, with such a pace of implementation of the programme of key importance for the improvement of air quality in Poland, it will be necessary to wait four years longer than planned, i.e. until 2033, to achieve the planned effects [5]. The reduction (reduction) of CO<sub>2</sub> emissions (Mg/year) of 1.4% or dust emissions of 0.8% to 2.3% also looks tragic.

## **3. Climate change**

The extent of climate change in Poland can be traced back to the IMiGW publication “Climate of Poland in 2021” [9] in which the following data are given for the period 1950–2020.

a) The temperature rise is documented by the following information:

- since 1851, the air temperature in selected major Polish cities has risen between 1.4 and 2.3°C;
- since 1951, the average annual temperature increase has been estimated at 2.0°C;
- in 2022, the number of hot days above 30°C was 2 times higher than the average from 1990 to 2020 and amounted to 19 days in Warsaw, 17 days in Kraków, 16 days in Szczecin, 13 days in Łódź [10].

Severe heat waves have occurred in Poland since the 1990s. High summer temperatures cause agricultural drought, crop losses and hydrological drought, including reduced surface water resources and lowered groundwater levels, drying up of lakes, rivers, ponds.

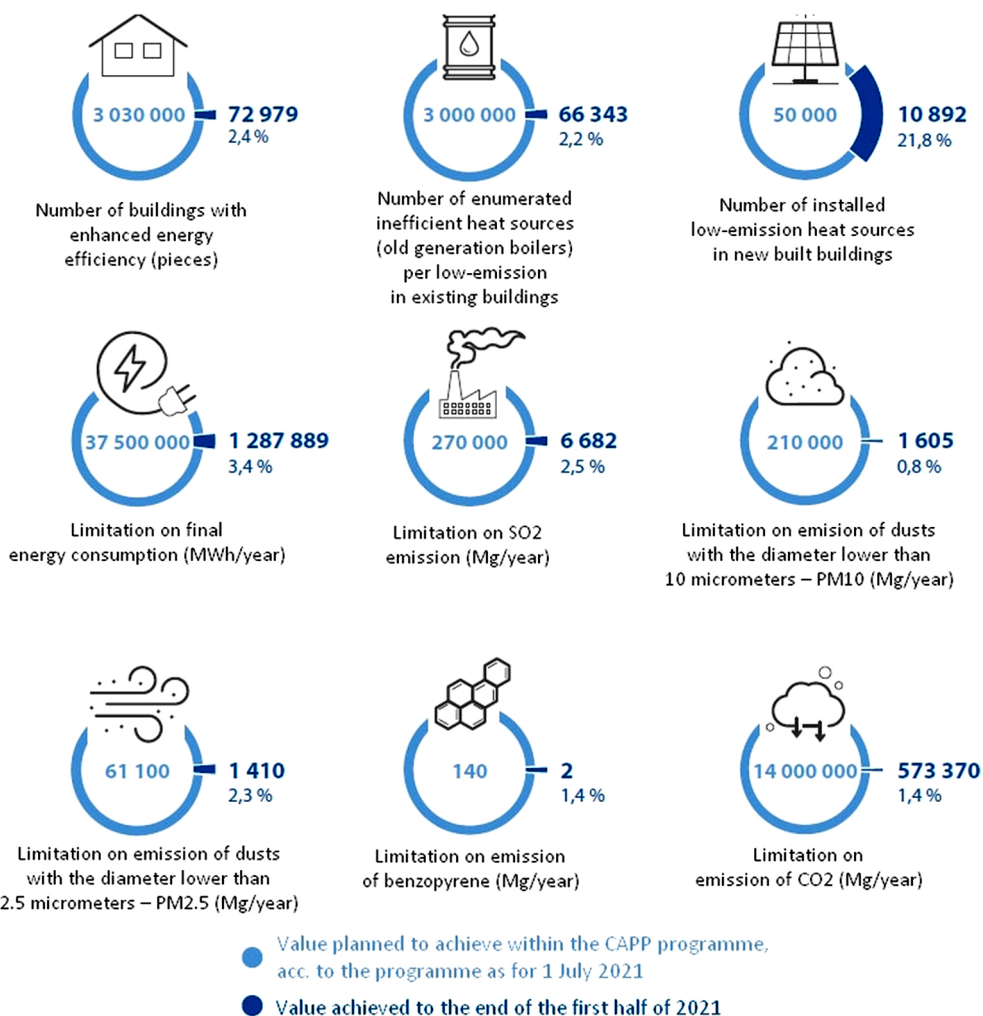


Fig. 3. Extremely low level of established physical effects of the Clean Air Priority Programme as at 1 October 2021, i.e. after 3 years of implementation [8]

#### b) Precipitation characteristics.

There has been a change in the volume and structure of precipitation in most areas of Poland. The averaged total precipitation in the period 1991–2020 was 600 mm and had a slight upward trend. The intensity of precipitation was characterised by considerable temporal and spatial variability. The intensity of thunderstorm precipitation and storms increased.

For example, in 2021, heavy rainfall occurred (among others) in Szczecin, Słubice and Poznań. In 2022, 130 mm fell in a 24-hour period in Gorzów Wielkopolski on 8 September. Similar rainfall occurred in Silesia on 30 August 2022 and also in Rabka in July 2023, causing

localised flooding. A decrease in the frequency of rainfall compared to previous years has resulted in a hydrological drought. The number of rain-free periods in most agricultural areas has increased.

c) Sea level rise.

In the period 1950–2020, sea level rise was recorded in Poland: in Świnoujście 13.1 cm, in Władysławowo 15.1 cm.

NASA studies have shown that sea levels will rise by one foot (about 30 cm) by 2050 [11] – if and only if there is no rapid melting of glaciers, in Greenland, the Arctic, Antarctica, Canada, the USA and Switzerland.

d) River flows.

The effects of summer droughts are taking a dramatic toll on river flows.

The level of flows has fallen dramatically in the last 10 years: in 2012 the minimum level was 55 cm – meaning that in 10 years it has decreased by 26 cm [12].

*In August 2022, the water level of the Vistula River in Warsaw was 29 cm, only 3 cm higher than the lowest level recorded in 2015 and 2018 [13].*

Low flows pose a serious threat to the water intakes for Warsaw and the water intakes for EC Siekierki and EC Żerań.

Sosnowska, in her study, points out that there is an urgent need for the city to intervene in regulating the flows of the Vistula River [12].

Since 2000, the author of this article has participated in many conferences and meetings with central authorities, as well as the mayors of the cities of Warsaw, Kraków, Wrocław, Łódź, Poznań, Gdańsk and the former COP, where he advocated the construction of retention reservoirs ready to hold millions of metres of rainwater (located where flooding occurred or near them) and the construction of polders. COP where he advocated the construction of retention reservoirs ready to hold millions of m<sup>3</sup> of rainwater (locating them where flooding occurred or in their vicinity) and the construction of polders on the main rivers in the country.

For example, in Warsaw, he pointed out such places, e.g. at the intersection (Służew nad Dolinka with Ciszewskiego Street) at the junction of Puławska and Karczunkowska Streets, in Stegny in Warsaw, etc., etc. These places were and are systematically waterlogged with every major rainfall (downpour).

There are thousands of such places in Poland and every town and city has them precisely located. It is enough to ask the residents or the Fire Brigade, which takes part in every action to pump water out of properties, cellars and underground garages.

It is also necessary to build polders, to reinforce embankments even with the help of killing sheet piling, e.g. from Larsen. The cost of making them along river embankments where floods occur is a fraction of the losses the Polish state has suffered over the past 23 years. This position is supported by scientists at the Silesian Academy, who call for the construction of retention reservoirs practically everywhere possible.

e) Air pollution.

Air pollution in Poland is a big problem. In 2018, WHO presented the 50 most polluted cities in Europe, of which as many as 33 were from Poland [14]. According to the Polish Smog Alarm (PAS), Nowy Targ is the city with the highest recorded air pollution in the entire



EU in 2021. The spas of Goczałkowice-Zdrój and Rabka-Zdrój are also among the most smog-polluted cities. Rybnik was for many years considered the Polish smog capital. It was here that all permissible air pollution standards were exceeded, even by 1,000 per cent. At present, after spending millions of zlotys and replacing class 1 and 2 cookers with low-emission ones (as part of the implementation of the anti-smog law), the situation has improved slightly. The average annual concentration of PM10 dust in Rybnik has reached the lowest result in the history of measurements [15]. It is important to know that scientists from the USA and Western Europe, by conducting studies over the last two decades, have proven beyond any doubt that: Smog causes numerous diseases (respiratory system, asthma, pharyngitis, heart disorders, coughing, shortness of breath, increased blood pressure, secretions blocking the sinuses, clogging the nose, causing chronic recurrent upper respiratory tract inflammation, development of bacterial and viral infections. In children, recurrent upper respiratory diseases, bronchitis, breathing difficulties, early childhood asthma, weakness, difficulty sleeping, interrupted sleep, general fatigue, drowsiness, loss of resistance to other diseases). Not to mention the losses to the economy from employee absenteeism, sick leave or population allergies due to air pollution. These losses amount to many billions of PLN annually.

## 4. Climate change adaptation programmes

A framework for the adaptation of societies to climate change and the necessary actions to delay climate change has been published in the following documents:

- Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (amending and subsequently repealing Directives 2009/28/EC of 23 April 2009, 2001/77/EC and 2003/30/EC), which set as a target to achieve at least a 32% share of energy from renewable sources and a 14% share of renewable energy in final energy consumption in the transport sector by 2030 [16].
- EU climate change adaptation strategy of April 2013, which identifies actions in key sectors vulnerable to climate change [17].
- Strategic Adaptation Plan for Sectors and Areas Vulnerable to Climate Change to 2020 with an Outlook to 2030, the so-called SPA2020 adopted on 29 October 2013 by the Council of Ministers of the Republic of Poland in which 44 cities with more than 100,000 inhabitants are committed to develop analogous programmes as a first step (The law is in the legislative process requiring cities with more than 20,000 inhabitants to develop adaptation plans) [1].
- *The new Climate Change Adaptation Strategy* adopted by the European Commission in 2021 – the document indicates that, in addition to climate change prevention, adaptation measures must be taken at all levels of society. The recommendations indicate the need to create economic incentives to create commitment from all stakeholders [18].

Despite the above-mentioned strategies adopted at many levels, the Polish authorities have taken **limited** regulatory action in recent years to increase the resilience of the economy to climate change, and have even introduced laws delaying the energy transition (the 2016 Law



on Conditions for Location of Wind Power Plants) [19] basing the economy on coal imports – at an average of about 10.0–16.0 million tonnes per year, as well as amendments to the law changing the conditions for selling energy produced by individual RES installations, which are favourable to prosumers [20].

In order to develop conclusions for the analysis, the author used a SWOT analysis in which he identifies the strengths and weaknesses of government projects, while external factors are included in the opportunities and threats.

#### 4.1. SWOT analysis – Strengths

The strengths of the adaptation of the economy to climate change are the implementation of investments with EU funds, among the important ones:

- 1) Implementation of the Świnoujście gas port and the *Baltic Pipe* pipeline.
- 2) Construction of oil and deep-water terminals in Gdansk.
- 3) Completion of the Opole and Koźienice combined heat and power plants.
- 4) Implementing the energy transition through support for renewable energy generators (RES) and an obligation for suppliers to obtain around 20% of 'green' energy. In Poland, RES sources account for 15% of the total energy generated.
- 5) Flood protection of the Żuławy.
- 6) Development of private RES sources in 2018–2022.

To summarise: the strength of the climate change adaptation policy in recent years has been the continuation of multi-year investments in gas and oil supply systems and power generation sources. According to the “National Energy and Climate Plan 2021–2030” [21] despite the continued upward trend in Poland's coal-fired electricity generation, CO emissions<sub>2</sub> from the aforementioned sector were reduced by only about 5% between 2011 and 2017.

#### 4.2. SWOT analysis – Weaknesses

Weaknesses are reflected in economic mismanagement, including but not limited to:

- 1) Unstable policy on the development of commercial power generation and waste of funds held. An example of this is the decision to build and demolish the Ostrołęka CHP plant and the loss of PLN 1.5 billion in funding, which could have been used for other tasks but was in fact wasted.
- 2) Unstable waste management legislation resulting in a halt to the construction of energy-from-waste (RDF) and bio-waste incineration plants generating energy, the lack of regulation of qualification systems for treated waste as RES energy and the arbitrary limitation adopted by the National Environmental Protection Fund of the financing of thermal treatment projects to 30% of the mass of waste produced. As a result, more than 40% of waste ends up in landfills, i.e. ca. 4.4 million tonnes. This is despite the fact that ca. 10 million people do not pay fees for municipal waste generation (10 million people are outside the fee system and the arrears of those who are in the system amounted in 2021 to PLN 760 million). In Poland, there are ca. 800 illegal hazardous waste dumps (including over 400 exceptionally hazardous wastes) stored de facto anywhere

without any legally required safeguards, de facto carcinogenic wastes, chemical wastes, mercury, lead, arsenic, cyanides, heavy metals, post-production wastes e.g. after TNT production are stored there with passivity of WOŚ, Ministry of Environmental Protection, Regional Environmental Protection Inspectors, Public Prosecutor's Office, police and local authorities etc., etc..

- 3) No programmes for the use of biomass from agriculture. In 2021, 128 biogas plants were in operation in Poland, 104 of which generated electricity [22]. In contrast, the NIK report of August 2021 states that in 2018 it was assumed that around 100 new biogas plants with a capacity of 40 KW would be built, but only 19 installations were built [23].
- 4) The 2016 Act on Conditions for the Location of Wind Power Plants introduced a criterion of a tenfold distance of the located facilities from buildings with residential or mixed functions [19] and from areas covered by forms of nature conservation (Rule 10H). Since then, almost no new wind installations have been built in Poland [24]. The law was amended on 9 March 2023, but at the last minute the basic parameter of the distance from inhabited buildings was changed from 500 to 700 m significantly limiting the possibility of building these installations [25].
- 5) Funds from the sale of CO<sub>2</sub> allowances have not been earmarked for climate transformation in recent years in accordance with the EU Directive (The Directive sets out the principle of allocating 50% of resources to climate change). According to former Deputy Prime Minister J. Steinhoff, *"Since the beginning of the auctioning of allowances, the state budget has been credited (...) with approximately PLN 57.5 billion"* of which only a part has been allocated to the energy transition [26]. (In 2021, Poland received EUR 5.59 billion for the sold allowances) [27]. In the explanation, the Ministry of the Environment stated that part of these funds are used to finance, among other things, the Clean Air programmes and denied that only 4% of these funds were spent on climate objectives. It is well known that these funds have been allocated to the needs of the budget, especially for social purposes [26].
- 6) In Poland, only 2% of energy comes from hydroelectric power plants and there have been no significant legal changes or economic preferences in the last 6 years [28]. In 2018, it was assumed that around 130 new small hydropower plants with a capacity of 35 KW would be built by the end of 2020 [23]. As of 14 December 2020, there were 27 hydroelectric power plants operating under the FIT/FIP scheme (RES sales scheme) [23].
- 7) The preparation of documents for the construction of the Siarzewo Hydroelectric Power Station was halted by the Minister of the Environment, who in August 2021. revoked the environmental decision [29]. In addition to generating electricity, the implementation of the project would make it possible to reduce drought in the Kujawy region.
- 8) The several-fold increase in coal prices in the second half of 2022 indicates that prices for this product have been much lower in previous years than the actual cost of ore, which should include the costs of maintaining active and closing mines and the costs of modernising environmental protection systems, including the construction of mine water desalination plants. The main reason was the lack of internal market protection mechanisms. The consequences include the emission of saline mine water and the

destruction of the Oder River ecosystem in August and September 2022, and the threat to the Vistula River and again to the Oder River in February 2023 according to the GREENPEACE report [30].

- 9) Lack of desalination of water (from virtually all mines) before discharge into the river and facilities such as the mine water desalination plant in Czerwionka-Leszczyny, which has been operating since 1974 based on technology developed in the United States and Sweden [31]. The plant obtains 70 tonnes of commercial salt per year. In 2023, some of the country's mines decided to build mine water desalination plants, planning to do so by 2030.
- 10) Lack of proper monitoring of water flow and pollution in Polish rivers – there are many illegal discharges of wastewater into rivers that no one monitors and eliminates [32]. In the Oder River alone there are ca. 1,000 such discharges.
- 11) Issuing water permits that do not take into account extreme climate changes, i.e. temperatures of 33–38 degrees Celsius or more, low water levels (i.e. significant concentrations of wastewater in rivers).
- 12) No orders to build industrial sub-treatment plants for every mine, factory and freshwater polluters e.g. from meat production, dairies etc., etc.
- 13) A multi-year delay in the construction of nuclear power plants. Plans to build them by 2035 are becoming increasingly unrealistic. (As of 31 July 2023, there is not a single environmental decision and not a single technological project let alone a construction project and funding is lacking). KHNP, a Korean partner of Polish companies in the construction of one of the large nuclear power plants, has been sued by the US nuclear power plant technology owner (Westinghouse) for violation of free competition by the Koreans copying their model. Until this dispute is resolved by an arbitration court, no work will start in Poland. According to the President of Westinghouse, Patrick Fragman, who made a public statement in April this year, the Pątnów nuclear power plant as a joint project of PGE, ZE PAK and KHNP will never be built, and there is a significant lack of financing for the plant to be built by Westinghouse, without which the construction of the nuclear power plant will not start either. The Polish government expected the US side to finance 50% of the construction costs, and the US side only agreed to 10%.
- 14) There is no programme for a strategy of transition of the Polish economy to a closed cycle and thus reduction of emissions into the atmosphere even by 25–30% CO<sub>2</sub>. We are not even at the stage of extensive “measurements”, i.e. a kind of audit in search of the biggest gaps in those areas of the economy where circularity has been introduced to the smallest extent.
- 15) Poland's lack of preparation for the hydrogen revolution coming in the next decade (2030–2040) [33].

The unfavourable structure of electricity production in 2019 and 2021 is shown in Fig. 4.

If the new wind law had not been introduced in 2016 (point 4) and the prosumer RES law had not been amended, and if more than 90% of the measures described in point 5 of this study had not been wasted, and if the assumptions for the construction of hydropower plants according to point 6 of this study and biogas plants according to point 3 had been realised, Poland would have produced ca. 40–50% green energy

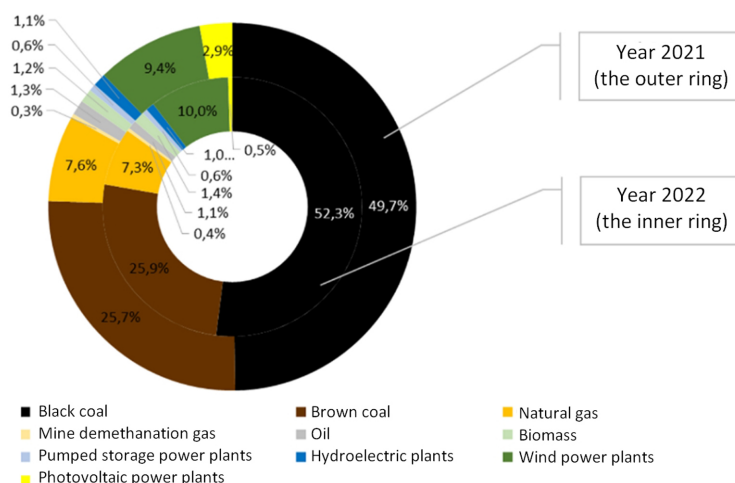


Fig. 4. Electricity production structure year 2019/year 2021 – POLAND [34]

instead of coal or lignite, and the energy would have been much cheaper than the current rates based on coal prices by up to 40–50%.

- 16) The introduction of monopolies in energy and fuel production, resulting in Poland having the highest energy prices in Europe in July 2023 (According to European Energy Exchange price tables).
- 17) Exceptionally slow, even tortoise, pace of implementation of enacted programmes on environmental protection, climate change (Low effectiveness of the Polish government in this respect).
- 18) Failure to update the SPA by 2020 (2030) and develop new up-to-date timetables to catch up with the Strategy.
- 19) No SPA until 2070, which was supposed to be developed by the IOC by the end of 2020 at the latest.
- 20) There is a lack of concept and strategy for ensuring drinking water for Poles after 2050. There is beginning to be a shortage of water in wells. Poland's water balance is getting worse every year. Evaporation as a result of the annual increase in temperatures and prolonged heatwaves (two to three weeks) is greater than the amount of moderate rainfall over many days. One cannot count on sudden, torrential rainfall, as the dry soil, the ground before it acquires its absorptive properties, will already be drained of rainwater like a gutter. According to the Institute of Meteorology and Water Management in Poland, there should be no shortage of this water for 20÷30 years, but already today society must take measures to save it and collect it (especially from storms, storms while preventing floods), in retention reservoirs and polders. We must also put an end to the pollution of rivers and groundwater, and do so immediately.
- 21) There is no strategy for the development of biomethane as a key energy source in Poland. Biomethane is a gas produced when biogas is purified. It is recognised in the EU as one of the most important EU RES sources. In the European Union, there were in 2022. 1200 biogas purification installations. Biomethane is a climate-neutral gaseous fuel which is

particularly important for the reduction of CO<sub>2</sub> into the atmosphere, as well as in the area of implementing a closed economy. It fits perfectly into the circular economy model.

- 22) The development of the biogas market in Poland is blocked by legislation (lack of appropriate legal regulations), the lack of financial support for investments and the low awareness of local communities and the problems faced by investors in connecting the gas produced to the grid.

### 4.3. SWOT analysis – chances of achieving objectives

In H1 2021, a National Recovery and Resilience Plan (NRRP) was developed and accepted by the European Commission. The 156.0 billion programme sets thresholds for climate targets (42.7%) and digital transformation (20.85%), among others. [35] The enactment of the NRRP and the receipt of these funds is key to the implementation of any climate change adaptation, energy transformation and digital transformation programmes. For the time being, i.e. in September 2023, it does not look like it, as the Polish government has not met the ‘milestones’ it has committed to the EU and signed the relevant documents in this regard.

The author identifies the following as the main directions that should be additionally addressed in the NRRP:

- implementation of climate change adaptation plans at all levels of social and economic activity, including adaptation programmes for cities irrespective of population;
- the development of professional and on-site power generation based on renewable energy sources (solar thermal, biomass, “waste to energy” including the conversion of specific waste fractions into hydrogen, hydropower);
- the development of prosumer energy in plants, joint investment in RES installations by so-called energy communities under conditions favourable to the public (private investors);
- the need to install remote energy reading meters (at a cost of ca. PLN 16 billion), i.e. 14,230,000 units. The remote reading meter allows the planning of the operation of domestic appliances and so, for example, heat pumps will draw energy from the grid when it is cheapest;
- Maintenance of preferential loans for the construction of solar power plants, biogas plants, hydroelectric power plants, wind farms through NFOŚ, WFOŚ, BOŚ;
- introduction of subsidies for RES installations amounting to 30–50% of the investment amount once the installations have achieved the design objectives, as well as cheap ecological loans with an interest rate including subsidies of up to 80% of the investment value;
- an increase in the country’s forest cover;
- prohibiting the construction of yards in towns and cities where there will not be 50% biologically active area;
- Restoration of favourable leasing rules for companies, enterprises investing in RES;
- Abolition of the law allowing NFOŚ funds to be used for the construction of motorways and reallocation of these funds to the elimination of environmental pollution hazards, i.e. air, water, land, according to criteria ranging from the greatest hazards through medium ones to the smallest ones. Establishing environmental protection priorities for the whole of Poland and for individual provinces, districts and communes;

- elimination of the so-called “ecological bombs” (threats to groundwater, rivers, soil) for which, according to estimates, more than PLN 2 trillion is needed and, without the help of budget and EU funds, their elimination or neutralisation will be impossible;
- dismantling of energy monopolies;
- Without a strategy to protect drinking water and provide it to Poles beyond 2050, and to save it by introducing new products and foods based on water-saving technologies, drinking water may become scarce;
- If the Polish government does not balance all budgetary and non-budgetary expenditures on investments in national defence, environmental protection, health care, science, other uniformed services, subsidies to local self-governments, etc., etc., and does not obtain assistance from the NAP and the EU budget, the chances of achieving the goals described in the “Adaptation Strategy. . . “ will be slim.

Poland’s economic system based on a free market economy will react to changes in the structure of available energy sources. The assumed plans for adaptation and transformation of RES energy generation sources require balanced state support from the NRP for social projects and a tax policy that inspires production facilities and industry to implement energy-efficient technologies. The lack of NRP funds in 2023 will make it practically impossible to implement the assumed plans from both NRP and SPA 2020 (2030).

#### **4.4. SWOT analysis – threats to the achievement of the objective**

NRP for Poland – consists of 54 investments and 48 reforms. The planned reforms are in fact new legal regulations – laws that should be developed as part of the government’s standard work. Missing from it are investments related to critical infrastructure, including but not limited to: energy, fuel, water and food supply; investments in rescue systems, hydrotechnical systems and wastewater treatment plants. The subject of (on line) satellite monitoring of river pollution in Poland and the elimination of illegal sewage discharges into all rivers in Poland is also unmentioned. An important issue should also be the expansion of power grids and the return to favourable conditions for the connection of prosumer RES to power grids (prior to the amendment of the law in 2022). and without completing, improving and launching the NRP for Poland, one cannot count on significant progress in environmental protection, which is a constitutional obligation of the state, as well as Poland’s obligation towards other countries of the world, Europe and international organisations such as the UN.

A number of topics are currently under call for proposals – although the legislative process of the NRP has not been completed, there is a lack of, inter alia, a law defining the form of social control including the Steering Committee and the fulfilment of the Polish government’s commitments in relation to the milestones written in the NRP (which the Polish government currently does not want to fulfil despite the conditions written in the NRP for the release of funds from the NRP) [36].

It should be noted that nuclear power generation, which will strengthen the basis of the system and influence the reduction of emissions from the sector, will be implemented according to the NRP only in 2033, which today seems unrealistic. During the transition period of the energy transition, an increase in the use of gas in the energy sector will be required, and this will necessitate its safe and stable supply and the creation of new generation capacity [37].

The challenge will be to simplify and make aid rules more flexible, as well as to ensure greater legislative stability in the area of RES regulations. Complicated procedures and frequent changes of regulations increase the investment risk of entrepreneurs investing in RES, thus limiting the possibility to credit investments as well as generate income from operations. Regulations must also take into account the development of technologies, new forms of cooperation (energy communities) and the need to integrate new weather-dependent RES capacities into the system (examples of related investments: offshore wind farms, development of smart energy infrastructure, energy storage, hydrogen technologies) [37].

Poland's priority should also be the construction of modern transmission lines and the modernisation of existing ones, as well as the construction of energy storage facilities by prosumers as well as industrial and commercial power plants.

Without this, Poland will not be able to produce electricity from new sources, i.e. RES, and transmit it to the national grid.

Analysis of losses and remediation costs resulting from climate change between 2001 and 2011 and projected losses for 2012–2030.

- Flooding and waterlogging caused losses of 0.08–0.1 per cent of GDP, but in 2001 and 2010 it was already around 0.5–0.9 per cent of GDP.
- Estimated losses directly caused by violent weather events in 2010 prices amounted to ca. PLN 56 billion.

If we add to this the cautiously estimated indirect losses as 60% of the direct losses, we obtain the amount of PLN 90bn, if we multiply this by 2.2 as approximate losses for the years 2012–2023 (8 months), this amount will be ca. PLN 200bn in 2010 prices, if we convert it to the prices of the second half of 2023, this amount will exceed PLN 300bn.

With the increase of extreme phenomena, hurricanes, tornadoes, storms, periods without precipitation (drought), occurrence of extreme heat 33–40°C in the shade, the losses predicted and their dynamics for the years 2012–2030 will significantly increase and may approach 400–500 billion PLN annually. In the aforementioned period there are also predicted threats to the entire water management in Poland as a result of its disturbance caused by droughts and later by intense downpours or even storms, which the dried soil will not absorb. These will cause flooding and waterlogging as well as slope or landslides.

E.g. The flood in Slovenia in August 2023 inundated 70% of the country. The previous great flood in Pakistan covered 37% of the country.

- The increase in extreme winds, hurricanes and tornadoes will pose a threat to windmill structures, overhead lines (transmission and distribution), as well as photovoltaic installations and wind and photovoltaic farms. Designers and technologists as well as constructors will have to develop new fixing systems, which will have to be met in order to make the above-mentioned constructions safe!
- An increase in temperatures of 2–4°C will cause considerable intensity and violence in the course of storms, will result in long-lasting sea storms, destruction of shores, local disappearance of beaches, dune erosion, coastal erosion on Hel and the central coast of Poland.



All of these phenomena will take on more extreme and surprising forms with each passing year and so E.g. for the first time in US history, flooding was reported in Alaska caused by the rapid melting of glaciers in the summer of 2023, where agitated river waters washed away houses that had stood on riverbanks for decades, causing them to be completely destroyed and swept away by the water.

Such and similar catastrophic phenomena of drought, fires occurred in 2023 in Europe and Africa around the Mediterranean, i.e. in Greece, Turkey, Italy, Spain, Portugal, Sicily, and in North America in Canada and the USA (where, e.g. in Hawaii on the island of Maui, according to data as of 21.08.2023, 114 people died and more than 850 are missing. 114 people and more than 850 are missing).

Catastrophic floods destroyed entire cities in China, India, Pakistan and also in South America. Where the rainwater caused disasters. Masses of land flooded towns with mud, causing the deaths of many people. Across the world, tens of thousands of people died in all extreme events in the six months of 2023 alone.

We all remember the bushfires in Australia in recent years, which, in addition to the loss of property, almost led to the extinction of the entire koala bear population.

Increasingly, weather phenomena as a result of climate change will increase in severity, intensity, to the point of regional or even national catastrophes.

If the world ignores climate change and does not introduce monitoring of extreme phenomena and develop ways to prevent their effects and drastically reduce greenhouse gas emissions, the world economy will lose hundreds of billions of dollars a year, causing further economic crises by reducing the annual GDP of individual countries by up to 2%, and this in turn will cause social unrest on an unprecedented scale.

Moreover, many conflicts and regional wars will break out around the world over water, but also over agricultural products, which will start to become widely scarce in many regions. This, in turn, will result in the migration of poor, hungry people on an unprecedented scale to more affluent countries that may not be able to cope with the problem, as is currently happening in Chile, where more than 2 million people have made their way through the Andes in search of work and food. These people migrate in unbelievable conditions, in rooms without running water, sanitation, in boarded-up kennels (without insulation) where in summer the internal temperature is equal to that outside at 40–50°C! But at least they have something to eat, one or two modest meals a day mainly from Africa and Asia.

The same phenomenon will affect Europe in 10–20 years, only the migration will be in the tens of millions of adults and children.

Although it is now five past twelve and nothing can prevent climate change-related disasters, there is still room to fight to reduce their impact and prepare for adaptation measures.

Let us also remember that if the Polish government does not finally start implementing and making up for the delay in the introduction of SPA 2020 (2030), according to a study published in the American journal "Management Science" of 108 countries studied by scientists from East Anglia and Cambridge (who tested these countries for their climate resilience using also artificial intelligence), as many as 59 countries will lose their current rating by the largest rating agencies, and this by 1 to 2 points by 2030. and by 4 points in 2100 (i.e. Polish investment or debt securities would be considered speculative), which will result in additional costs of servicing loans taken out on global credit markets, as well as problems in selling treasury bonds, etc. As a result, Poland could be considered an insolvent country in 2100.

Finally, in order to make everyone aware of the position Poland occupies in Europe when it comes to environmental protection, let me post 2 tables from the May 2022 Ranking of the Greenest (A green state is a state that places environmental and climate concerns high on its agenda and supports this with appropriate legislation and budgetary spending) EU countries [38].

Table 1. Ranking of green countries [38]

No.	Country	Ranking score
1.	Malta	59.4
2.	France	57.4
3.	Sweden	55.7
4.	Spain	54.9
5.	Portugal	54.2
6.	Croatia	53.8
7.	Slovenia	53.7
8.	Germany	50.9
9.	Slovakia	50.6
10.	Austria	50.5
11.	Latvia	50.3
12.	Netherlands	49.0
13.	Italy	48.8
14.	Ireland	47.5
	European Union (27 member states)	47.0
15.	Hungary	46.9
16.	Denmark	46.7
17.	Greece	45.7
18.	Belgium	45.5
19.	Cyprus	43.3
20.	Lithuania	42.5
21.	Bulgaria	40.7
22.	Romania	39.1
23.	Czech Republic	38.5
24.	Finland	38.1
25.	Luxembourg	37.4
26.	Estonia	36.1
27.	Poland	34.0

Table 2. Countries' efforts to create the most responsible country in the EU for environmental protection and greenhouse gas reduction [38]

No.	Country	Ranking score
1.	Malta	65.5
2.	Sweden	53.7
3.	France	49.7
4.	Denmark	49.5
5.	Germany	48.5
6.	Austria	45.2
7.	Netherlands	44.8
8.	Portugal	42.7
9.	Bulgaria	40.9
10.	Ireland	38.8
11.	Spain	38.8
12.	Slovenia	37.8
	European Union (27 member states)	37.5
13.	Belgium	36.6
14.	Croatia	36.3
15.	Luxembourg	36.2
16.	Slovakia	35.5
17.	Romania	32.7
18.	Finland	32.3
19.	Italy	31.0
20.	Hungary	31.0
21.	Estonia	30.9
22.	Latvia	30.7
23.	Czech Republic	30.5
24.	Greece	27.4
25.	Cyprus	26.4
26.	Poland	20.0
27.	Lithuania	19.1

## 5. Summary

The energy transition needs to be accelerated as this is one of the important climate goals, but this must be done while reducing energy costs on the internal market and adapting the economy to increasing market competition. In addition to wind energy and photovoltaics, an under-exploited raw material area is the surplus of unused biomass in agriculture in the form of biogas plants and local incineration plants. It is also necessary to build incineration plants in each voivodship as a source of feedstock from waste that cannot be further recycled and, depending on needs, to convert it into electricity or heat by eliminating the burning of lignite and hard coal. In order to realise local plants and organise the production of raw material, statutory changes are needed to enable such plants on agricultural land, initiatives by producers' unions, the patronage of chambers of agriculture and local authorities. A component of the EU's energy transition is the closed-cycle economy, the main aim of which is the recovery of raw materials and energy. Considering that a statistical Pole in 2020 produced 342 kg of waste of which more than 70% went to landfills [39] – energy recovery requires vigorous action and appropriate regulation. The (total) 42.0 million tonnes of dumped coal imports between 2017 and 2020 was a trap that limited the development of new energy generation technologies and halted mine modernisation. Bringing the market into balance requires a fundamental shift in energy policy towards RES.

The list of priorities in Poland in the field of environmental protection, i.e. air, water and land protection until 2030, needs to be re-established. (incineration plants, biogas plants, water and air monitoring, elimination of illegal landfills, nuclear power plants, wind and photovoltaic farms) and to plan financing for the above-mentioned areas using budgetary and EU funds, as well as NFOŚ, WFOŚ and BOŚ funds.

The Polish executive is not taking proper care of the environment – this is confirmed by the report of the Schuman Foundation and the Adenauer Foundation entitled “Europe Against Climate Catastrophe” [40]. It contains a ranking of the most environmentally caring EU countries (For this reason it is also referred to as Europe's green ranking). Poland scored 34 points out of a possible 100 and was ranked last. The Polish authorities performed particularly disastrously in the category “state climate action”, where Poland received 20 points, with the average of EU countries being 38 points, and we also took last place. Without a change of attitude on the part of those in power and without prioritising environmental protection issues, employing relevant environmental protection specialists and giving them appropriate competences (decision-making positions), as well as mobilising funds from the NRP – there will not be even a shadow of a chance for any improvement in this area in Poland.

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## **Analiza “Strategii adaptacji dla sektorów i obszarów wrażliwych na zmiany klimatu do roku 2020 z perspektywą do roku 2030 (SPA 2020)”**

**Słowa kluczowe:** zrównoważony rozwój, zielone strategie, SPA 2020, OZE

### **Streszczenie:**

Polska wypada bardzo źle we wszelakich rankingach związanych z ochroną środowiska i zwykle zajmuje w nich końcowe miejsca w stosunku do innych krajów UE. Obecnie jest realizowanych kilka programów i strategii, które mają za zadanie poprawić tę sytuację. Są to zarówno dokumenty o szczeblu krajowym, jak i samorządowym. Autor przedstawia najważniejsze z nich i dokonuje analizy zarówno ich zapisów jak i skuteczność ich wdrażania. Jednym z kluczowych aspektów adaptacji do zmian klimatu jest transformacja energetyczna Polski z energetyki opartej na węglu (obecnie ok. 67%) do źródeł odnawialnych (OZE stanowią obecnie ok. 18%). Niestety na przestrzeni ostatnich lat ustawodawcy i regulatorzy znacząco zahamowali ten proces, szczególnie w zakresie energii z fotowoltaiki (niekorzystne zmiany dla prosumentów) oraz energii wiatrowej (ograniczenie lokalizacji nowych inwestycji) a także biogazowni. Znaczącym problemem jest również ograniczenie finansowania tej transformacji, ze względu na blokadę przez instytucje UE wypłaty środków z Krajowego Programu Odbudowy. Bez odblokowania tych środków i skutecznej realizacji istniejących już programów i strategii, Polska pozostanie jednym z najbardziej zanieczyszczonych krajów UE z archaicznym miksem energetycznym i będzie ponosiła daleko idące konsekwencje na rynkach finansowych, aż do obniżenia ocen kraju przez 3 największe firmy ratingowe.

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