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EVALUATION OF THE ATTAINMENT OF ENVIRONMENTAL GOALS IN SUSTAINABLE GROWTH REGARDING GAS EMISSION AND ENERGY CONSUMPTION, AS DEFINED FOR POLAND IN THE EUROPE 2020 STRATEGY

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K e y w o r d s: reduction of greenhouse gas emission, renewable energy, guidelines for Poland.

A b s t r a c t

In March 2010, the European Commission announced a 10-year strategic plan called 'Europe 2020 – A strategy for smart, sustainable and inclusive growth'. At the same time, the Polish authorities approved several strategic documents connected with the Lisbon Agenda and the new Europe 2020 Strategy, intended to support the development of RER and the reduction of emissions, mainly of greenhouse gases. The objective of this study has been to assess the indicators of sustainable growth for Poland against the backdrop of these indicators for the European Union. The analysis included indicators related to gas emission and energy consumption in the years 2004, 2010 and 2015. For each indicator, a so-called demonstration assessment value was calculated, which shows by what percentage the value of a given indicator achieved in Poland is better or worse than the average value of this indicator for the European Union member states The study showed positive changes in the individual indicators in 2004–2015.

OCENA REALIZACJI CELÓW ŚRODOWISKOWYCH ZRÓWNOWAŻONEGO ROZWOJU W ZAKRESIE EMISJI GAZÓW I WYKORZYSTANIA ENERGII PODJĘTYCH DLA POLSKI W STRATEGII EUROPA 2020

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S ł o w a k l u c z o w e: redukcja gazów cieplarnianych, energia ze źródeł odnawialnych, zużycie energii, założenia dla Polski.

Abstrakt

W marcu 2010 r. Komisja Europejska ogłosiła dziesięcioletni plan strategiczny zatytułowany *Europa 2020. Strategia na rzecz inteligentnego i zrównoważonego rozwoju sprzyjającego włączeniu społecznemu*. W tym czasie w Polsce zatwierdzono wiele dokumentów strategicznych dotyczących strategii lizbońskiej i nowej strategii *Europa 2020*, które wspierają rozwój OZE i redukcję emisji gazów, głównie cieplarnianych. Celem badań była ocena wskaźników zrównoważonego rozwoju Polski na tle wskaźników dla Unii Europejskiej. Analizą objęto wskaźniki emisji gazów i zużycia energii w latach 2004, 2010 i 2015. Dla każdego wskaźnika obliczono tzw. ocenę demonstracyjną, która pokazuje, o jaki procent wartość danego wskaźnika dla Polski jest lepsza lub gorsza od jego średniej wartości dla krajów Unii Europejskiej. Przedstawione wyniki badania wykazały pozytywne zmiany w poziomach poszczególnych wskaźników w latach 2004–2015.

Introduction

The world's economic growth has been achieved at the expense of the natural environment, including shared resources (WELZER, WIEGANDT 2011, p. 71). In 1969, the U'Thant's Report demonstrated cause-and-effect relationships in the then current state of the Earth's environment, and predicted the fate of humanity in the event of lacking prevention measures, thus changing the awareness of the international community and politicians. In the ensuing discussions and events, over the following decade or so, the concept of sustainable growth was developed and firmly rooted. Rapidly changing needs, driven by economic, social and political changes, have enforced certain alterations in the approach to sustainable development. Thus, the development of the idea of sustainable growth did not terminate at the stage of producing numerous definitions and principles, but has continued rather dynamically until now. According to BORYS (2014, p. 1–19), the overriding idea of sustainable development, which proclaims the right to satisfy the developmental aspirations of the present generation without compromising the rights of future generations to satisfy theirs, has become excessively general in the context of the current paradigm of development (sustainable, durable, self-sustaining eco-development). What is required of us today is to possess specific indicators which should be measured and the goals to be achieved at specific levels of management. This approach calls for the monitoring and assessment of sustainable development over time, which is best to be done with measurable and comparable indicators. More on the achievements in the research methodology in this domain can be found in BORYS (2005, p. 9–22).

Research methodology

The research objective has been to assess changes in the emission of greenhouse gases and renewable energy generation in Poland against the backdrop of the analogous indicators for the European Union. The first year covered by the study was when Poland accessed the EU, the next one was the year when the Europe 2020 Strategy became effective and the final year analyzed was the one made available on stat.gov.pl. The source of data was the domestic information module of GUS (Main Statistical Office in Poland) for international comparisons (accessed on: http://wskaznikizrp.stat.gov.pl/, access: 06.07.2017). The comparative indicator method was applied to analyze all indicators available in the module for Poland and for the European Union. More on the selection of domains and indicators can be found in BALAS, MOLENDA (2016, p. 98–114) and WITKOWSKA-DĄBROWSKA (2016, p. 299–309). Two indicators belonged to stimulants (the more, the better) while three were destimulants (the more, the worse). The so-called demonstration assessment value was calculated for each indicator, showing by what percentage a given indicator was better or worse than the average value for all EU member states (28). The data for the EU in 2004 and 2010 were calculated for all the countries which are now in the European Union, regardless of their accession date. The evaluation was performed according to the following formulas:

- for stimulants

$$O_1 = \frac{W_i - W_{\text{min.}}}{W_{\text{max.}} - W_{\text{min.}}} \tag{1}$$

- for destimulants

$$O_1 = \frac{W_{\text{max.}} - W_i}{W_{\text{max.}} - W_{\text{min.}}} \tag{2}$$

- by what percentage the indicator is better or worse than the EU average

$$O = \frac{O_i}{O_{\text{average}}} \cdot 100\% - 100\% \tag{3}$$

where:

O_i – value of indicator W_i for Poland, converted to a zero-to-one scale,
O_{average} – average value of the indicator for the European Union, converted to a zero-to-one scale,
O – assessment result,
W_i – value of the indicator for Poland,
$W_{\text{min.}}$ – minimum value of the indicator among the EU countries,
$W_{\text{max.}}$ – maximum value of the indicator among the EU countries,
W_{average} – average value of the indicator for the European Union.

Consequently, an assessment was made for each indicator, showing by what percentage it was better or worse in Poland compared to the EU average (ROGALA 2005, p. 237–246). The research results were discussed and presented graphically in a table.

Results and Discussion

The article focuses on indicators connected with the environmental goals in the scope of climate and energy. The importance of these issues cannot be overestimated. The unavoidable consequences of climate change are discussed broadly and in great depth by BLEWITT (2014, p. 394) and MULLIGAN (2014, p. 330). Both authors present the historical and political background, simultaneously providing evidence that the public opinion, and especially business and political elites, may not be persuaded to recognize the problem unless confronted with the economic consequences of climate change. What matters is to ensure that decision-makers realize that the changing climate causes negative economic effects. Also, the Paris Agreement underlines the necessity of warning people against the consequences of global warming and the resulting losses. Internationally, it is the European Union that excels in the implementation of measures to protect the climate. The EU was one of the first leading economies which presented its planned contribution to climate protection. The plan is to reduce emissions by at least 40% by the year 2030. Pursuant to the Paris Agreement, a consensus has been reached regarding the long-term goal such as to keep the increase of the global average temperature at no more than 1.5°C above the level prior to the industrial era. This would create a chance to reduce the human impact on climate change and its consequences (OLKUSKI et al. 2017, p. 91–102). This is a more ambitious target than the one agreed on earlier in Copenhagen, where nearly 200 countries declared their intention to reduce global warming to 2°C relative to the pre-industrial era (KARACZUN, SOBOLEWSKI 2010, p. 1–9). Reaching a goal such as reducing the rise in temperature by 2°C would involve a net emission reduction down to zero around the year 2050, whereas limiting the temperature rise down to 1.5°C would mean that net emission should be decreased to zero by the year 2030. Meanwhile, it is important to reach the maximum level of emission globally as soon as possible. It needs to be underlined that developing countries[1] will need more time than developed ones to achieve the level that will be followed only by the reduction of emission. The aim is to obtain a balance between the emission from anthropogenic sources and the absorption of greenhouse gases by the mid-21st century. The developed countries have declared to provide developing countries with financial support by transferring 100 billion

[1] Countries outside Annex 1 of the Kyoto Protocol.

US dollars annually to finance investment projects which would reduce emission (PIWOWARCZYK-ŚCIEBURA, OLKUSKI 2016, p. 93–108).

The documents passed under the Paris Agreement assume that over half of the greenhouse gas emission reductions will be achieved by the European Union Emission Trading Scheme, known as the EU ETS. Another consequence of the above agreement was to intensify changes in the implementation of technologies that use black or brown coal as energy carriers. According to OLKUSKI et al. (2017, p. 91–102), the greatest challenge was to persuade China and the USA to sign the agreement, as these two countries are responsible for nearly 44.5% of the world's emission of CO_2. Despite the success, less than 1.5 years after the ratification of the Paris Agreement by the then US president Barack Obama, the next American president, Donald Trump, declared that the USA would withdraw from the agreement.

One of the causes of GHG emission is the high consumption of coal by the power generation industry. Unfortunately, there are very large disproportions in the production of coal among the EU member states as well as other countries. While some states have decreased coal production over recent years and have declared that they will completely cease the use of coal over the next 10 to 15 years (e.g. the UK, Finland, France), others are either constructing or planning to construct new coal power plants (e.g. Greece, Poland) (ROCHA et al. 2017, p. 10–34). Meanwhile, the actual role of coal in unfavourable climate changes is being debated, and there are many proposals to reduce the contribution of coal in energy production. A solution could be to raise the coal prices so as to diminish its competitiveness relative to other energy sources which generate fewer emissions (KNOPF, EDENHOFER 2014, p. 1–5). Furthermore, ROGAL (2010) claims that the energy policy needs reforming. Special attention should be drawn to an analysis of underlying causes of the excessive exploitation of natural resources and possible preventive measures. Management of the demand side and more efficient use of renewable energy resources, such as water power or biogas, create a large potential to achieve an equilibrium in energy consumption. In the EU, legal documents are being implemented which envisage the reduction of GHG emissions in the long-term perspective, for example A Road Map for Moving to a Competitive Low Carbon Economy in 2050, which the European Commission resolved to accept in 2011, foresees that the emission of greenhouse gases in the European Union should decrease by 80–95% by the year 2050. According to LOREK (2016, p. 162–171), the pursuit of this aim will be futile unless an agreement is achieved with the biggest global players in the power market, i.e. with China and the USA. After the US President declared a change in his country's standpoint, the demand for coal, and consequently coal mining, will increase (OLKUSKI et al. 2017, p. 91–102).

In March 2010, the European Commission announced a 10-year strategic plan called *Europe 2020. A strategy for smart, sustainable and inclusive growth*, which somehow superseded the Lisbon Strategy. The new strategy was preceded

by numerous consultation documents[2] produced by the European Commission, where models of the EU development were proposed.

The Europe 2020 Strategy posed a question as to 'where we want Europe to be' in the year 2020. Referring to this question, the Commission suggested several overriding, measurable goals to be achieved in the EU. Due to the different starting points in individual member states, different achievement levels were established. The goals included environmental ones, such as 20/20/20 (*Europe 2020. A strategy…* 2010) regarding climate and energy (including the reduction of carbon dioxide by as much as 30% if the conditions are right), and the target for Poland is to reduce consumption of primary energy down to about 96 Mtoe[3], to increase the use of renewable energy sources, and to reduce emission of CO_2. Both the Lisbon Strategy and the Europe 2020 Strategy were developed on the grounds of sustainable development. An in-depth discussion regarding mutual relationships between the Lisbon Strategy and sustainable development (SD) is provided by STEURER and BERGER (2010, p. 1–22), who point to the problems arising from the lack of cohesion on the international level between the strategic documents and applied indicators. The reasons why these strategies seem to fail, ranging from excessive goals to exorbitant costs, are identified by ŻMUDA (2011, p. 200–210).

The outcome of the implementation of the above resolutions should be real and monitorable changes. Five sustainable growth indicators in the domain of environmental order (Tab. 1) have been chosen to assess the current state relative to the evaluation made at the stage of Poland's accessing the EU and at the moment the Europe 2020 Strategy was adopted. These indicators are connected with the targets set in the Europe 2020 Strategy.

Generally, the growth in the use of renewable energy sources across the EU has decelerated in the last few years (*Policy paper…* 2013, p. 18). As a result, and contrary to global trends, investments into renewable energy sources in the EU decreased from over 120 billion USD in 2011 to over 50 billion USD in 2015. Europe has lost the position of being the global leader in clean energy generation, which is now occupied by China (PRANDECKI 2014, p. 52–66). China has recognized the important role of advertising campaigns and education in attaining better low-emission awareness of the society (WEN et al. 2015, p. 2261–2267). Conversely, an imperfect mechanism of support for photovoltaics in some countries (the Czech Republic, Spain) has led to a crisis. The initially

[2] Consultation of European Regions and Cities on New Strategy for Sustainable Growth. A new Lisbon Strategy after 2010. Final Report, Committee of the Region, The EU's Assembly of Regional and Local Representatives, 2010. Consultation on the Future „EU 2020" Strategy, Commission Working Document, Commission of the European Communities, Brussels, COM(2009)647 final, 2009. Europe 2020, The New Lisbon Strategy, Social and Economic Council, Hague, July 2009.

[3] Tonne of oil equivalent (toe) is an energy equivalent of one metric tonne of crude oil having a net calorific value of 10,000 kcal/kg. It is mainly used in the power industry to express large amounts of energy. 1 Mtoe = 1,000,000 toe.

Table 1

Evaluation of sustainable growth indicators in the domain of environmental order

No of indicator	Nature of the indicator	Name of the indicator of sustainable growth	Year	Indicator Size for the EU-28				Rating above / below the average in the European Union
				Poland	max.	min.	European Union	[%]
1	s	share of energy from renewable sources in final gross energy consumption [%]	2004	6.90	38.70 (Sweden)	0.10 (Malta)	8.30	–17.00
			2010	9.30	47.20 (Sweden)	1.00 (Malta)	12.90	–26.00
			2015	11.80	53.90 (Sweden)	5.00 (Malta)	16.7	–39.00
2	s	share of energy from renewable sources in transport fuel consumption [%]	2004	0.70	3.80 (Sweden)	0.00 (Cyprus. Ireland) Malta)	1.00	–30.00
			2010	6.60	10.90 (Sweden)	0.00 (Cyprus)	5.20	8.00
			2015	6.40	24.00 (Sweden)	0.40 (Estonia)	6.70	–7.40
3	d	greenhouse gas emission in tonne of oil equivalent [%] 1988=100%*	2004	70.70	146.65 (Spain)	42.85 (Latvia)	94.85	49.00
			2010	72.23	123.12 (Spain)	42.06 (Lithuania)	83.04	26.00
			2015	68.48	115.84 (Portugal)	43.69 (Lithuania)	71.35	8.00
4	d	greenhouse gas emission per unit of consumed energy [%]	2004	98.40	106.30 (Luxemburg)	86.40 (Czech Republic)	96.60	–19.00
			2010	98.00	117.60 (Lithuania)	83.80 (Czech Republic)	92.80	–27.00
			2015	91.50	112.00 (Bulgaria)	74.20 (Finland)	89.10	–10.00
5	d	energy consumption by economy [kgoe/1000 euro]	2004	329.70	630.60 (Bulgaria)	85.80 (Denamark)	151.60	–35.00
			2010	278.30	464.90 (Bulgaria)	82.40 (Denamark)	137.70	–44.00
			2015	227.30	448.50 (Bulgaria)	62.00 (Ireland)	121.60	–33.00

*without Cyprus and Malta.

Source: the authors, based on http://wskaznikizrp.stat.gov.pl/, Eurostat.

high financial support stimulated an intensive development of solar farms, which has encouraged some other countries to reverse the changes implemented in their support mechanism and moratoriums on the development of renewable energy sources. The high rise in RER in Spain was a result of the widespread promotion of this source of energy, dependent on the so-called guaranteed prices, i.e. *Feed-In-Tariff* – FIT (KRZYKOWSKI 2015, p. 24–32, after MONTOYA et al. 2014, p. 526). KRZYKOWSKI (2015, p. 24–32) underlines the fact that despite the undisputable success of renewable energy generation in Spain noted over the past twenty years, the economic effects of the FIT scheme ultimately proved to be destructive. Among a number of factors involved, the researcher identified two key ones; they are the tariff deficit and the amount of subsidies to RER which do not correspond to the market conditions. The economic problems connected with the use of renewable energy resources are also highlighted by PINDÓR and PREISNER (2009, p. 145–153).

Regarding climate and energy, the Europe 2020 Strategy envisages the reduction of carbon dioxide emissions by as much as 30%. This target is to be achieved through a greater use of energy from renewable sources. One of the indicators analysed in this study was the share of energy from renewable sources in the final gross energy consumption. According to NORWISZ et al. (2006, p. 10–20), each of the newly passed legal documents, acts and resolutions, constructs its own definition of RER, paying little attention to its compliance with the Polish legislation or with the European Union law. The definitions used in this article are consistent with the ones applied by the Polish Central Statistical Office GUS (stat. gov. pl)[4].

Energy from renewable sources means energy originating from natural, reproducible processes in nature. The final gross energy consumption means the energy carriers supplied for energy purposes to industries, the transport sector, households, and services; including public services, agriculture, forestry and fisheries. This also includes the consumption of electric power and heat by the power generating industry to produce electricity and heat, together with electric power and heat energy losses during energy transfer and distribution. This indicator informs us about the contribution of RER energy to the final energy consumption countrywide, and allows us to monitor the effects of actions undertaken to promote production and consumption of renewable energy in all sectors. The use of this indicator is justified by the challenges that Poland is facing with regards to the reduction of energy consumption by the country's economy in the medium- and long-term time period.

In the years analysed, the indicator of the RER energy share in the final gross energy consumption in Poland increased but was less than the EU average. At this point, it is worth making a reference to the structure of consumed energy derived from renewable resources in particular sectors of the economy.

[4] All indicators presented in this study originate from the database of GUS, Eurostat.

The report presented by SCHNELL (2016, p. 5–10) contained an analysis of the chances of reaching the goal set in the Directive[5]. It is assumed that the 15% share of RER expected from Poland should be contributed as 54% RER energy generated in the heating and cooling sector, 25% by the electricity industry and 21% by transport. In the heating and cooling sector, the energy from renewable resources is mostly generated by co-combustion of solid fuels (biomass). In the electricity sector, the record-high years 2012 (co-combustion) and 2015 (wind power plants) were followed by a period of stagnation induced by the new system of subsidies and an investment funding gap. However, the worst situation is noted in transport. Since 2011, the share of 'green fuel' used in transport has been declining steadily, mainly because Poland has failed to undertake any action to develop the sector of second generation biofuels (from waste products). Consequently, despite the growth of energy production from RER, the value of this indicator as an average for the whole of the EU has increased at a faster rate. Between 2004 and 2010, the comparative assessment for Poland decreased by 8.9 percentage points, and in the consecutive years the decline was even more rapid, and accounted for another 13 percentage points until 2015. Among all the EU states, the highest value of this indicator in all the years analysed appeared in Sweden, while the lowest value was persistently noted in Malta.

The second indicator examined is the share of energy from renewable sources in transport. By analogy to the previous indicator, worth noting is the low CO_2 emission caused by the use of biofuels, which is of particular importance as the number of vehicles on roads is continually increasing. The indicator is calculated as the share of energy from renewable sources in all types of transport in the final consumption of energy in transport.

This indicator also scored the highest values in Sweden, while being the lowest in Cyprus, Ireland and Malta (in 2004), only in Cyprus in 2010 and in Estonia in 2015. In Poland, a large increase in the indicator's value was noted between 2004 and 2010, although it then fell slightly in 2015. This was reflected in the evaluation results. In 2004, the indicator's value was 30% less than the EU's average, in 2010 it was 8% higher in Poland than in the EU on average, and in 2015 it was just 7.4% below the EU's average again. Such fluctuations indicate that Poland is finding it difficult to keep pace with the other EU countries.

The third indictor submitted to our analysis is a destimulant, namely the emission of greenhouse gases expressed in CO_2 equivalent terms, i.e. expressed in the universal greenhouse gas emission unit, which reflects the diverse values of the global warming coefficient. For Poland, the base year for reporting the fulfillment of the obligations arising from the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol is the year 1988.

[5] Directive of 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (the Directive) defined the shared framework for the promotion of energy from renewable resources.

For industrial gases (HFCs, PFCs, SF_6), the base year for Poland is 1995. The adopted equivalent of carbon dioxide is one megagram (1 Mg) of carbon dioxide or an amount of any other greenhouse gas which is the equivalent of 1 Mg of carbon dioxide calculated with the help of global warming coefficients. A global warming coefficient is the indicator which compares the impact of a greenhouse gas on climate warming to the impact produced by carbon dioxide; it is calculated on the basis of effects of an impact of one kilogram of a given gas on climate warming over 100 years compared to the impact produced by 1 kg of CO_2.

The lowest values of this indicator were found in Latvia, followed by Lithuania, while the highest ones were achieved in Spain, except in 2015, when Portugal scored higher. The value of this indicator in Poland varied between the three analysed years. In 2004, it declined by over 2 percentage points, which is desirable. Noteworthy, the values of this indicator in Poland were above the EU average in all the years analysed. However, this apparent 'success' in reducing the emission relative to the base year (1988) was mainly due to a change of the political system and the subsequent economic transformation (locking down heavy industry plants). The initially high reduction was followed by increasingly smaller values, i.e. first a reduction by over 21 percentage points, and subsequently by over 15 percentage points. The recent economic crisis has not contributed largely to a higher reduction in emission. Should the same tendency continue, the value of this indicator assessed for Poland in 2020 would be less than the EU average, and Poland would no longer be the 'leader' in reducing emission. The same tendency is confirmed by PAJEWSKI (2016, p. 2014–2018), who analysed the emission of greenhouse gases in agriculture. The direct emission of greenhouse gases associated with agricultural production constitutes about 1/7 of the global emission of gases to the atmosphere. The EU countries have decreased such emission owing to some updated technologies, e.g. integrated agriculture, decreased consumption of artificial fertilisers, or a smaller number of livestock. In Poland, however, there are numerous barriers to the implementation of significant changes. These include fragmentation of farmland, deeply rooted habits among farmers, and – regarding reclamation of soils – uneasy logistics due to the flooding of organic soils. Moreover, BRZEZIŃSKI and BUKOWSKI (2011, p. 17–47) claim that simple reduction reserves have been exhausted in Poland and, as the country's economic growth continues, we should expect an increase in the volume of consumed energy as well as emitted greenhouse gases.

The fourth analysed indicator, likewise a destimulant, refers to the emission of greenhouse gases per unit of consumed energy. This indicator shows the connection between the domestic consumption of energy and the emission of greenhouse gases (i.e. the impact of the power sector on the environment). The consumption of fossil fuels is the main source of emission of carbon dioxide (CO_2). Due to the demand for energy, this is the driving force of greenhouse gas emission.

The lowest emission was detected in the Czech Republic and Finland, while the highest occurred in Luxemburg, Lithuania, Latvia and Bulgaria. Unfortunately, the emission of greenhouse gases in Poland was quite high (although it fell by 6.9 percentage points between 2004 and 2015), and the evaluation relative to the EU average per unit of consumed energy was low. In 2004, it was about 18.56% below the EU average, and in 2010 it fell to 21% below the average. However, some improvement was noted in 2015, and the assessed value was 10% below the EU average.

The fifth analysed indicator was the energy consumption by economy, expressed in Kgoe/1000 euro. It is the ratio of the domestic gross energy consumption to the gross domestic product value (in constant prices of 2010, converted to the euro according to the currency exchange rate in 2010). Over the years studied, this indicator decreased in value in Poland, which is a favourable trend considering that this is a destimulant. The value of this indicator in all the years was the highest in Bulgaria and the lowest in Denmark. In Poland, it reached a value below the EU average in all the three years analysed, ranging from 33% to 44% below it. This can be attributed to large, positive changes that have occurred in Poland compared to the other EU countries. The Europe 2020 Strategy assumes that the total primary energy consumption in Poland should decrease to about 96 Mtoe. Based on the achieved values of this indicator, it is only possible to indicate a decreasing tendency, both in Poland and with respect to the EU's average.

Summary

The research reported above reveals certain changes in the levels of particular indicators between 2004 and 2015. In Poland, they were nearly always positive changes. Some important conclusions from the present study are:

A decrease in the emission to air expressed by the CO_2 equivalent was noted. Likewise, the emission of greenhouse gases expressed per unit of used energy decreased.

The European Union member states are to decrease their emission of CO_2 by as much as 30% compared to the level noted in 1990, to increase the contribution of energy from renewable sources into the total energy basket of the EU by 20%, and to improve the energy efficiency by 20%. As regards GHG emissions, including the emission of CO_2, and energy consumption by economy, some improvement can be seen in the entire EU and in Poland. In the EU, a decrease by 16% since 2011 was noted (data not published by the GUS), and the said indicator tended to decrease in value. Should this tendency continue, there is a chance that the set goal will be approached gradually, but this would probably require additional measures to obtain the expected reduction.

Poland's targets are to increase the share of RER power in energy balance, and to decrease GHG emissions. In 2004, the share of energy from renewable resources in final energy was 6.9%, increasing to 11.8% in 2015, and the respective percentages in energy used for transport were 0.7% in 2004 and 6.4% in 2015.

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