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Implementation of Selected Sustainable Development Objectives in European Union Countries

Abstract. The aim of the paper is to assess the implementation of selected sustainable development objectives in European Union countries with particular focus on Poland. Several different indicators were taken into account: greenhouse gas emission, share of renewable energy, GDP energy intensity and protection of environment and biodiversity, which cover goals set in The Europe 2020 Strategy, among others: reduction of carbon dioxide emission, increase share of renewable energy usage, increase the effectiveness of energy usage, preservation of biodiversity. It was found, that European Union countries generally strive towards achieving those goals, though the effectiveness differs among them. Poland positively pursues all discussed issues. However, is not the leader in any of them. It is important to underline, that analysed data seem to allow to say, that it is possible to achieve objectives set in Europa 2020 Strategy.

Key words: sustainable development, European Union, sustainable development objectives, greenhouse gas emission, energy efficiency, renewable energy

JEL Classification: Q01, Q15, Q42, Q54

Introduction

Sustainable development is one of the mail concerns in European Union. Many actions are being taken to ensure that European Union is leading in the direction of sustainability. It is important, because of many risk of associated with more conventional development, such as dependence on fossil fuels, growing demand for natural resources that increase the pressure on the environment, climate changes. Furthermore, with the leading role in sustainable development European Union can possibly increase its competitiveness. By taking this development path is stands out among not only developing countries, but also highly developed countries.

The Europe 2020 Strategy describes general goal for European Union in regards to its development till 2020. The Strategy is based on three priorities (Komunikat Komisji…, 2010):

- smart development - development of economy based on knowledge and innovation;
- sustainable development – supporting economy that is more resource efficient, more environmental-friendly and more competitive;
- inclusive growth – supporting economy characterized by high employment level and ensuring economic, social and territorial cohesion.

In accordance to climate and energy there are several goals set for European Union countries in The Europe 2020 Strategy, among others: reduction of carbon dioxide emission

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by 20% (in comparison to 1990), increase share of renewable energy usage up to 20% and increase the effectiveness of energy usage by 20%. It is also important to underline the place of biodiversity preservation in that Strategy.

The aim of the paper is to assess the implementation of selected sustainable development objectives in European Union countries with particular focus on Poland.

Methodology

The paper uses the Eurostat and Central Statistical Office data about the European Union countries, with particular focus on Poland, for different years up to 2015. Different timeframes in accordance to different factors analysed are due to the availability of data in the Eurostat database. Data concern topics such as: greenhouse gas emission, share of renewable energy, energy intensity of GDP, protected terrestrial area and protected breeds of livestock. Those factors were chosen to cover sustainable development objectives considered in the paper. Simple statistical methods of data processing were applied and the obtained data were presented as figures and tables.

Results

Several different indicators were analysed in order to assess the way European Union countries realise sustainable development objectives in relation to environment and agriculture. The first one is greenhouse gas emission.

Greenhouse gas emission in the European Union was decreasing over the analysed period of time – from 5,2 to 4,3 billion tonnes of carbon dioxide equivalent – drop by 16,3%. Relevant data for 10 countries with the greatest volumes of emissions are shown on figure 1. The largest emitters – Germany, United Kingdom, France and Italy – emitted more than 400 million tonnes of carbon dioxide equivalent each in 2015. However, it is worth underlining, that each country also achieved a decrease in emission – respectively by 7,2%, 25,1%, 14,0% and 22,9% in 2015 in comparison to 2007. Furthermore, not only the largest emitters fulfil their goals in greenhouse gas emission reduction. What is really significant from the point of view of meeting the goals of sustainable development, is the fact that all European Union countries were reducing their emissions in the analysed period of time. The rate differs from -6,3% (Netherlands) to -30,3% (Denmark). It shows, that the goals set have real chances to be achieved.

Figure 2 presents data on greenhouse gas emissions in agriculture in the European Union countries in 2007-2015 for the 10 biggest emitters. Agriculture across the European Union emitted in 2015 more than 436 million tonnes of carbon dioxide equivalent – 0,5% less than in 2007. The share of agricultural greenhouse gas emission in total emission was 10.1% in 2015. It increased in the analysed period by 1.5 percentage points. When comparing data on figure 1 and figure 2 the certain pattern can be seen – most countries with highest emission in total, are also the countries with highest emission from agriculture.

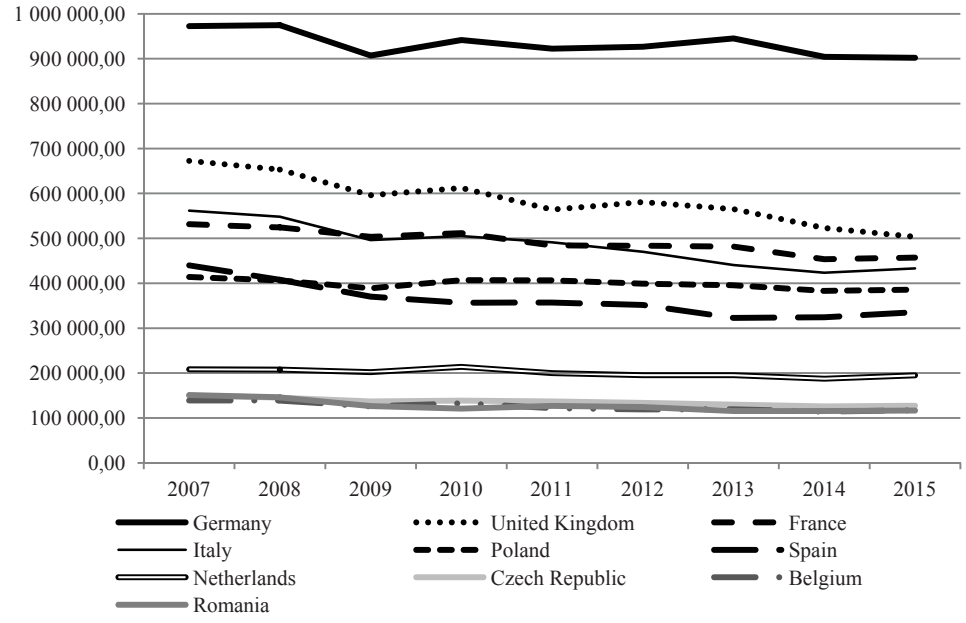


Fig. 1. Greenhouse gases emission in selected European Union countries (thousand tonnes of carbon dioxide equivalent) in 2007-2015

Source: Eurostat.

As mention above, the nominal decrease in agricultural emissions can be seen across the European Union, although significant disproportions between the countries can be observed. Greenhouse gas emissions generated by agriculture increased in the analysed period in half of the European Union countries. This is an utmost unfortunate phenomenon considering sustainable development in agriculture and climate changes. In three countries: Bulgaria, Latvia and Estonia, this increase was very high, as the emission volumes there went up by a dozen or more percent. As regards countries in which agricultural greenhouse gas emissions decreased in the analysed period, the greatest drops were recorded in Cyprus (-13.1%), Malta (-12.3%) and Romania (-9.7%). In Poland the decrease was by 3,9%. Sustainable development objectives were set for countries, not particular economy sector. Nonetheless, for countries to achieve those goal its sectors have to reduce emissions. From that point of view it is very unfortunate, that in half European Union countries agriculture increased its emissions.

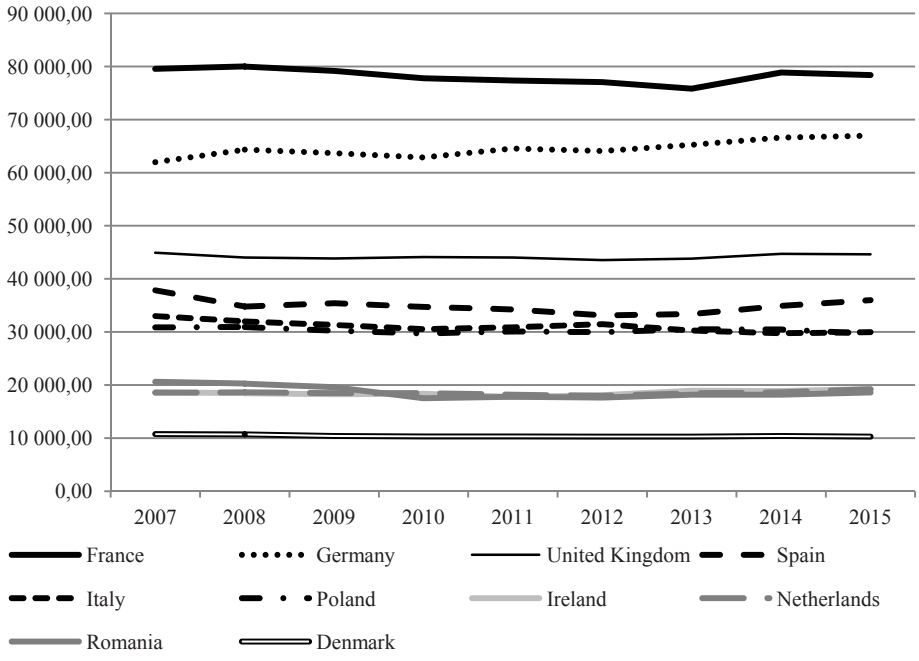


Fig. 2. Greenhouse gases emission in agriculture in selected European Union countries (thousand tonnes of carbon dioxide equivalent) in 2007-2015

Source: Eurostat.

The author in cooperation with Konrad Prandecki carried out separated studies about selected greenhouse gas emissions in agriculture in Poland (Prandecki, Gajos, 2017). Results from the study are shown in table 1.

Taking into consideration, that presented data are not fully compatible with data from figures 1 and 2 because of differences in their scope (both timetable and substances analysed), it is interesting to analyse changes in agricultural emissions in details – broken down by substances. Analysing four selected substances: carbon dioxide, nitrous oxide, methane and nitrogen oxides, it can be observed that the highest drop was observed in case of nitrogen oxides (by more than 18.5%) and carbon dioxide (almost 14%), while emissions of nitrous oxide and methane remained stable. However, it is worth noting that the emission of nitrogen oxides is low compared to the other three gases discussed in the study – in carbon dioxide equivalent, it is less than 0.3% of total emissions. As a consequence, the overall reduction of analysed emissions from agriculture in the discussed period is mainly due to limiting carbon dioxide emissions. Significant reductions in emissions of nitrogen oxides did not produce such an effect due to their small share of total emissions.

The second analysed indicator is renewable energy. Data about shares of renewable energy in gross final energy consumption in European Union countries in 2006-2015 is shown in table 2. About 16,7% of energy in European Union in 2015 was obtained from renewable sources. There was an increased in that ratio by 7,2%. To achieve 20% share of renewable energy another increase by 3,3% is needed.

Table 1. Greenhouse gases emission in Polish agriculture in 2008-2014

Specification	2008	2009	2010	2011	2012	2013	2014
	Emission volume (thousand tonnes)						
Carbon dioxide	16904,4	16029,0	17034,0	16370,6	15998,9	14568,6	14568,6
Nitrous oxide	56,0	54,9	53,1	54,5	54,3	55,5	54,8
Methane	582,0	571,1	572,8	569,7	567,9	570,0	576,2
Nitrogen oxides	191,4	177,2	185,7	185,2	185,3	165,2	155,6
	Emission volume (thousand tonnes of carbon dioxide equivalent)						
Carbon dioxide	16904,4	16029	17034,4	16370,6	15998,9	14568,6	14568,6
Nitrous oxide	14851,1	14517,4	14080,6	14445,6	14391,9	14720,1	14515,5
Methane	16295	15990,5	16037,8	15951,4	15902	15959,8	16134,3
Nitrogen oxides	134	124	130	129,7	129,7	115,6	109
Sum	48184,4	46661	47282,7	46897,2	46422,5	45364,2	45327,3

Source: Eurostat; Prandecki, Gajos 2017.

There are big differences between European Union countries in that ratio. Countries with the highest shares (more than 30%) of renewable energy were: Sweden, Finland, Latvia, Austria and Denmark. In Sweden more than 50% of energy used was the renewable one. Another few countries were characterized by higher than 20% share of renewable energy: Croatia, Estonia, Lithuania, Portugal, Romania and Slovenia. In total, eleven European Union countries already achieved 20% use of renewable energy and therefore the goal set. The lowest shares (less than 10%) were in Luxembourg, Malta, Netherlands, Belgium, United Kingdom, Ireland and Cyprus. Those countries are far from achieving 20% renewable energy share and it is unlikely, that it will be achieved in foreseen time. In Poland the ratio equals to 11,8%.

All countries are meeting the sustainable development goal related to increasing the share of renewable energy, however, the scale differs significantly. In case of Netherlands, Luxemburg, Malta and Poland it increased by less than 5 percentage points. In case of Sweden, Estonia and Denmark it was more than 10 percentage points.

Figure 3 presents data about final energy intensity of GDP with climate correction in Poland and European Union in 2000-2013. It is one of the ways to assess the effectiveness of energy usage.

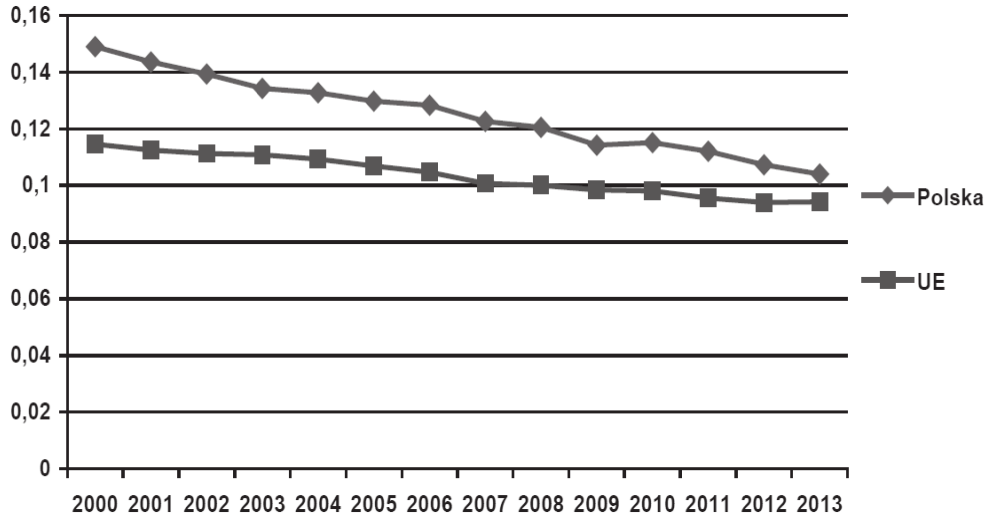
The final energy intensity of Poland's GDP with climate change correction equaled to 0.104 in 2013 and was 11% higher than the European Union average of 0.094. Effectiveness of energy usage in Poland was significantly lower than in European Union. However, the rate of energy intensity improvement in Poland was almost twice higher in the years 2000-2013 than in the European Union (2.7% vs. 1.5%). That means, that Poland is improving its effectiveness and it foreseen future there is a real chance to achieve the same level of GDP energy intensity as average for European Union countries.

Drawing conclusions from this indicator it can be said, that European Union in general, and Poland in particular, are achieving the goal set for energy efficiency usage. Poland’s rate of improvement is much higher though.

Table 2. Shares of renewable energy in gross final energy consumption in European Union countries in 2006-2015,%

Specification	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
European Union	9,5	10,4	11,0	12,4	12,9	13,2	14,4	15,2	16,1	16,7
Austria	25,4	27,2	28,1	29,9	30,4	30,6	31,4	32,3	32,8	33,0
Belgium	2,6	3,1	3,6	4,7	5,7	6,3	7,2	7,5	8,0	7,9
Bulgaria	9,6	9,2	10,5	12,1	14,1	14,3	16,0	19,0	18,0	18,2
Croatia	22,7	22,2	22,0	23,6	25,1	25,4	26,8	28,0	27,9	29,0
Cyprus	3,3	4,0	5,1	5,6	6,0	6,0	6,8	8,1	8,9	9,4
Czech Republic	7,4	8,0	8,6	9,9	10,5	11,0	12,8	13,8	15,1	15,1
Denmark	16,3	17,8	18,6	20,0	22,1	23,5	25,7	27,4	29,3	30,8
Estonia	16,1	17,1	18,9	23,0	24,6	25,5	25,8	25,6	26,3	28,6
Finland	30,0	29,6	31,3	31,3	32,4	32,8	34,4	36,7	38,7	39,3
France	9,3	10,1	11,1	12,1	12,5	11,1	13,4	14,1	14,7	15,2
Germany	7,7	9,1	8,6	9,9	10,5	11,4	12,1	12,4	13,8	14,6
Greece	7,2	8,2	8,0	8,5	9,8	10,9	13,5	15,0	15,3	15,4
Hungary	5,1	5,9	6,5	8,0	12,8	14,0	15,5	16,2	14,6	14,5
Ireland	3,1	3,6	4,1	5,1	5,6	6,6	7,2	7,7	8,7	9,2
Italy	8,3	9,8	11,5	12,8	13,0	12,9	15,4	16,7	17,1	17,5
Latvia	31,1	29,6	29,8	34,3	30,4	33,5	35,7	37,1	38,7	37,6
Lithuania	16,9	16,5	17,8	19,8	19,6	19,9	21,4	22,7	23,6	25,8
Luxembourg	1,5	2,7	2,8	2,9	2,9	2,9	3,1	3,5	4,5	5,0
Malta	0,2	0,2	0,2	0,2	1,0	1,9	2,8	3,7	4,7	5,0
Netherland	2,8	3,3	3,6	4,3	3,9	4,5	4,7	4,8	5,5	5,8
Poland	6,9	6,9	7,7	8,7	9,3	10,3	10,9	11,4	11,5	11,8
Portugal	20,8	21,9	23,0	24,4	24,2	24,6	24,6	25,7	27,0	28,0
Romania	17,1	18,3	20,5	22,7	23,4	21,4	22,8	23,9	24,8	24,8
Slovakia	6,6	7,8	7,7	9,4	9,1	10,3	10,4	10,1	11,7	12,9
Slovenia	15,6	15,6	15,0	20,1	20,4	20,3	20,8	22,4	21,5	22,0
Spain	9,2	9,7	10,8	13,0	13,8	13,2	14,3	15,3	16,1	16,2
Sweden	42,7	44,2	45,3	48,2	47,2	48,7	51,1	52,0	52,5	53,9
United Kingdom	1,5	1,8	2,7	3,3	3,7	4,2	4,6	5,7	7,1	8,2

Source: Eurostat.



*) kgoe – kilogram of equivalent oil, euro2005 – market value of euro in 2005 with the purchasing power of the currency.

Fig. 3. Final energy intensity of GDP with climate correction in Poland and European Union in 2000-2013 [kgoe/euro2005*]

Source: GUS 2016.

The last analysed indicator in accordance to sustainable development objectives relates to protection of environment and biodiversity.

Data about protected terrestrial area in European Union countries in 2004-2015 are presented in table 3. In European Union the average of 18% of terrestrial area was protected at different level in 2015. Earlier it was 13%. Enlargement of the European Union to new member countries caused increased in that ratio – the share of protected terrestrial area in new member countries were significantly high, for example Croatia – 37% and Bulgaria 34%.

In general the share of protected terrestrial differs between countries from less than 10% (Denmark and United Kingdom) to more than 25% (Bulgaria, Croatia, Cyprus, Greece, Luxembourg, Slovakia, Slovenia and Spain). In Poland that ratio equalled to 20% in 2015. In general, some increase in the ratio level was observed in many countries.

The last discussed issue concerns protection of farm and wild animals. It is an important element in protection of biodiversity and environment in general. Livestock Genetic Resources Conservation Program is a program, which focuses on protection of rare farm animals in Poland. Generally, it concerns breeds, that came originally from the territory of Poland and which rearing was limited in last decades for many reasons. In Poland a total of 79 breeds are currently protected under that program (Bioróżnorodność…, 2017):

- Cattle - 4,
- Pigs - 3,
- Horses - 7,
- Sheeps - 15,
- Poultry - 35,
- Fur animals - 6,

- Fish - 7,
- Bees - 1,
- Goats - 1.

Table 3. Protected terrestrial area in European Union countries in 2004-2015, %

Specification	2004	2007*	2010*	2013	2015
European Union	-	13	13	18	18
Austria	11	11	11	15	15
Belgium	10	10	10	13	13
Bulgaria	-	-	30	34	34
Croatia	-	-	-	37	37
Cyprus	-	7	13	28	29
Czech Republic	-	9	10	14	14
Denmark	7	7	7	8	8
Estonia	-	17	17	18	18
Finland	13	13	13	14	14
France	7	8	9	13	13
Germany	7	10	10	15	15
Greece	16	16	16	27	27
Hungary	-	15	15	21	21
Ireland	10	10	11	13	13
Italy	14	14	14	19	19
Latvia	-	11	11	12	12
Lithuania	-	10	14	12	12
Luxembourg	15	15	15	18	27
Malta	-	13	13	13	13
Netherlands	10	8	8	13	13
Poland	-	7	11	20	20
Portugal	17	17	17	21	21
Romania	-	-	13	23	23
Slovakia	-	12	12	30	30
Slovenia	-	31	31	38	38
Spain	23	23	24	27	27
Sweden	14	14	14	14	13
United Kingdom	7	7	7	9	9

*) 25 countries

Source: Eurostat.

In case of wild animals, the list consists of 591 species (Rozporządzenie…, 2016) including:

- Mammals – 51,
- Birds – 427,
- Reptiles – 5,
- Amphibians – 10,
- Fish – 5,
- Others – 93.

It can be seen, that protection of both farm and wild animals covers a long list of breeds and species. It is both a good and bad indicator. The fact, that there is a need to create protection programs indicates, that something is not right for there to be any endangered species. On the other hand, it is good that effort is being put to protect those already endangered animals.

Discussion

It is worth mentioning, that while available literature quite broadly describe and analyse the problem of sustainable development from theoretical and socio-economic points of view, the environmental point of view is not so well described.

For example Czech (2013) compared the competitive position of the economy with sustainable indicators, but only the socio-economic ones concerning employment, expenditures on research and development or education. Her analysis proves the lack of contradiction between the achievement of goals set in Europa 2020 Strategy and the competitive position of European Union economies. Busłowska (2014) attempted to evaluate the implementation of development goals in eastern Polish regions contained in the "Strategy for the social and economic growth of Eastern Poland by 2020" in the context of sustainable development. Again, she focused on aspects connected with economy development, employment, infrastructure. It was found, that the realisation of the Strategy has to be assessed positively. Changes in indicators level were significant, however, it was not determined whether they are permanent or not.

In author's studies it was shown, that all European Union countries, including high-developed countries with strong economies, are realising sustainable development objectives concerning climate change and biodiversity. It is a different aspect of Europa 2020 Strategy or Strategy concerning Eastern Poland and different goal, however all goals set in Europa 2020 Strategy are connected with sustainable development. Therefore dependencies described by Czech (2013) and Busłowska (2014) are in correspondence with author's studies.

Data analysed in the paper allow to formulate the conclusion, that Poland is on the way to sustainable development, is not however the leader among European Union countries. The same conclusion was drawn by Katoła (2013). She studied the level of sustainable development in Poland and other European Union countries and focused on indicators related to the quality of life. She found, that Poland is in the middle of the ranking set based on Sustainable Society Index and Happy Planet Index. Similar studies were carried by Imiołczyk (2016). She, however, focused not only on socio-economic aspects of sustainable development, but also include in considerations ecologic ones, for example renewable energy usage. Her findings were similar to the ones of Katoła (2013) and author's own ones. It was concluded, that Poland positively realise sustainable development objectives.

Conclusions

Sustainability is at the heart of the European Union's development strategy. The objectives of sustainable development are being achieved by each European Union country, but with varying effectiveness. Poland positively pursues all discussed issues:

- Reducing greenhouse gas emissions - low emissions' reduction rate compared to other European Union countries;
- Increasing share of renewable energy - average share of renewable energy among European Union countries, but low rate of increasing the this ratio level;
- Increasing energy efficiency – energy efficiency of GDP higher than average in the European Union, but much higher rate of decreasing its level;
- Biodiversity conservation - relatively high percentage of protected terrestrial areas.

In accordance to other European Union countries it can be said, that there are positive changes in consideration to analysed sustainable development objectives. However, countries differ in case of the scale of those changes and closeness to the final goal. All European Union countries reduce greenhouse gas emission. In the years 2007-2015 it fall from -6,3% (Netherlands) to -30,3% (Denmark). In case of shares of renewable energy in gross final energy consumption eleven European Union countries already achieved 20% use of renewable energy and therefore the goal set. All countries are increasing that share. In European Union about 16,7% in average of energy usage in 2015 was obtained from renewable sources and the ration is increasing. Also the energy efficiency measured by final energy intensity of GDP with climate change correction is improving.

It is important to underline, that analysed data seem to allow to say, that it is possible to achieve objectives set in Europa 2020 Strategy by European Union in general and by member countries.

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