

Convergence or divergence of the European Union's energy strategy in the Central European countries?

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Abstract

Even though there is no common energy policy, EU energy strategy sets the background of the energy landscape in Europe. EU energy policy responds to different challenges in the energy market. One of them is climate change. Growing emissions of greenhouse gases aroused world's interest aimed at reducing the harmful impact of the energy industry on the environment. The European Union has undertaken a low-emission strategy set out in the package called "3x20". The aim of the study is on one hand to present program measures and regulations taken in the EU in the recent period for sustainable energy management and reduction of greenhouse gas emissions and on the other try to assess program's implementation by Member States. The article presents the current state in terms of achieving the objectives of the "3x20" package in 2017, with a special diagnosis of conditions and trends in the Central and Eastern Europe countries that joined the EU after 2004. Paper includes the analysis of the official EU documents within energy policy and empirical evidence on their implementation. The analysis uses the literature review and data from the Passport, Eurostat and OECD databases. Methods employed in this study include critical literature review and secondary data analysis.

Keywords: low-carbon economy, Central and Eastern Europe, climate policy

Introduction

Growing greenhouse gas emissions (GHG-greenhouse gases) and global warming actively involved the European Commission in international action to counteract climate change. The activity of the European Union (EU) in this respect was an expression of the policy pursued in the field of environmental protection. This activity contributed also to actions for the sustainable development of Europe in line with the provisions of the Treaty on European Union (TEU).

An important area affecting the level of greenhouse gas emissions and, consequently, climate change is energy management. The energy industry emits significant amounts of carbon dioxide to the atmosphere, contributing significantly to the greenhouse effect. Therefore, it has been recognized that the transformation of the energy industry towards replacing conventional energy carriers with

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renewable energy carriers (RES), through modern, and innovative energy technologies; may be a key issue in mitigating climate change.

The goal of this study is to, on one hand, present EU from the sustainable energy management perspective and reduction of greenhouse gas emissions, and on the other assess their implementation by the Member States. Therefore, research question checks how progressed are Central European countries with the implementation the EU's energy strategy.

The study analyzes the initiatives and activities undertaken in between 2000-2017 in EU as part of the energy and climate policy aimed at the transformation of the EU economy into a low-carbon economy. Low-carbon economy is characterized by the dominance of renewable sources in the energy balance, at the expense of conventional energy carriers; reduction of energy consumption through increased energy efficiency; innovation and use of new, clean energy technologies along with modernization of energy infrastructure. Those solutions should result in building a modern, competitive economy and environmentally friendly economy offering Europe new job possibilities, social inclusion and energy security. It is also assumed that thanks to a decrease in costs in the energy industry and technological development that would improve the flexibility of energy suppliers, such transformation will be possible. Transformation processes visible in the structure of energy produced will be accompanied by changes on the part of energy consumers and their needs, in particular related to the development of electro mobility.

The study presents the current state of achievement of the objectives of the package 3 x 20 in the EU 28, with a special diagnosis of conditions and trends in this area in the countries of Central and Eastern Europe that joined the integration group after 2004. The analysis includes the structure of domestic energy resources and their use, dependence on imports of conventional energy carriers and emissions, pointing to the economic, social and institutional conditions for their development towards a low-emission economy. On the basis of the conducted research, authors indicate the areas in which, on one hand, significant progress has been made in recent years and, on the other, those which require more attention and support.

In order to prepare this study authors used the literature of the subject, the EU documents regarding the strategy of building a low-emission economy in the European Union, referring to energy and climate policy, legal regulations, reports and industry studies. Paper is structured as follows: firstly, authors look at official documents within the respective areas and then provide an empirical evidence using secondary data. The latter analysis is based on data from the Passport, Eurostat and OECD databases.

1. Energy policy of the European Union - towards a low-carbon economy – regulatory practice

The theoretical basis for building the concept of a low-emission economy is the concept of sustainable development within the ecological economy framework. This idea assumes that economic development can only take place within the limits of nature's tolerance. This includes the need for selective economic development, greater coherence of activity, increasing efficiency and care for the exhaustibility of natural resources. Transforming the EU economy into a low-carbon economy means integrating all aspects of the economy around low-emission and zero-emission energy technologies. They include: effective energy solutions, the use of renewable energy sources and environmentally acceptable technological innovations. Low-carbon economy is also characterized by efficient management of energy resources in relation to production, transmission, distribution and consumption processes. That includes also use of wastes generated during whole energy life-cycle process. The above given activities should be pursued minimizing greenhouse gas emissions at the same time. The strategy of building a low-emission economy is to contribute, apart from the expected reduction of greenhouse gas emissions, to economic growth and new jobs, competitiveness of selected sectors and the whole EU economy, reducing the EU's dependence on oil and gas imports, but also improving the quality of life.

The EU sustainable development strategy in the area of energy management and climate change towards long-term low-carbon economy was presented in 2011 in the *A Roadmap for moving to a competitive low carbon economy in 2050* (European Commission, 2011). It was the next stage of the activities that had been initiated earlier, and visible in the *EU Energy Strategy* (European Commission, 2007) and the *EU Strategy for socio-economic development Europe 2020* (European Commission, 2011). At the same time, it was an impulse for further actions, followed by the establishment of the political framework for climate and energy for the period 2020-2030 (European Commission, 2014), and a document defining the vision of the creation of the Energy Union (European Commission, 2015). Its basis, as stipulated in the Commission's communication, is an ambitious climate policy based on cooperation between Member States in five inter-related areas, namely: efforts to decarbonize the economy, energy security, solidarity and trust, an integrated European energy market, energy efficiency, and in the area of research, innovation and competitiveness.

In order to achieve long-term emission targets in the climate and energy package, quantitative targets have been set for reducing CO₂ emissions by at least 20% in 2020 compared to base 1990, increasing the share of renewable energy in final energy consumption to 20% by 2020 including a 10% share of biofuels in the use of fuels, and an increase in the use of energy efficiency by 20% by

2020 compared to the forecast for the demand for fuels and energy. Then, for the years 2020-2030, the above indicators were set at a higher level of 40%, 27% and 27%, respectively¹. By 2050, transforming the EU into a competitive and low-carbon economy means, according to the *Roadmap* (European Commission, 2011), reduction of emissions by 80% (up to 95%), compared to the level in 1990. Achieving these goals will require profound changes in the structures of EU Member States' economies with particular emphasis on energy-intensive sectors, apart from energy including also construction and services, industry, transport and agriculture.

The estimates assume that the emissions reduction will take place gradually along with the growing use of low-emission technologies. This will mean: production of electricity and heat in dispersed sources, the abandonment of the use of conventional energy carriers and the transition to a more efficient, sustainable energy system in the EU (Wojtkowska-Łodej, 2016, pp. 331-311). Along with the adoption of the low-carbon economy strategy, a number of coordinated activities were undertaken in the past period. They concentrated in the fields of: industry, transport, R & D policy, innovation and infrastructure policy, improvement of the business environment and financial support, integrating energy and climate projects².

A few years before the end of 2020, one can observe desirable trends in the development of common reduction targets in the EU. This applies to the share of energy from renewable sources in final gross energy consumption (since 2005), energy efficiency as well as greenhouse gas emissions. Trends correspond to relative changes compared to 1990 levels.

Against the background of positive trends regarding the implementation of common reduction targets for the EU 28, there is a significant differentiation among Member States, in particular with regard to the reduction of greenhouse gas emissions (Eurostat, 2017a, p.264, EEA, 2017, p. 20). It results from the domestic conditions, in particular from the situation in the scope of energy resources and their domestic energy balances.

2. Member states from Central and Eastern Europe (CEE): conditions for development – empirical evidence

Central and Eastern European region joined the EU successively in 2004, 2007 and 2015. The Czech Republic, Estonia, Lithuania, Latvia, Poland, Slovakia, Slovenia and Hungary participated in the first, enlargement, followed by Bulgaria, Romania and Croatia. This group of countries in the

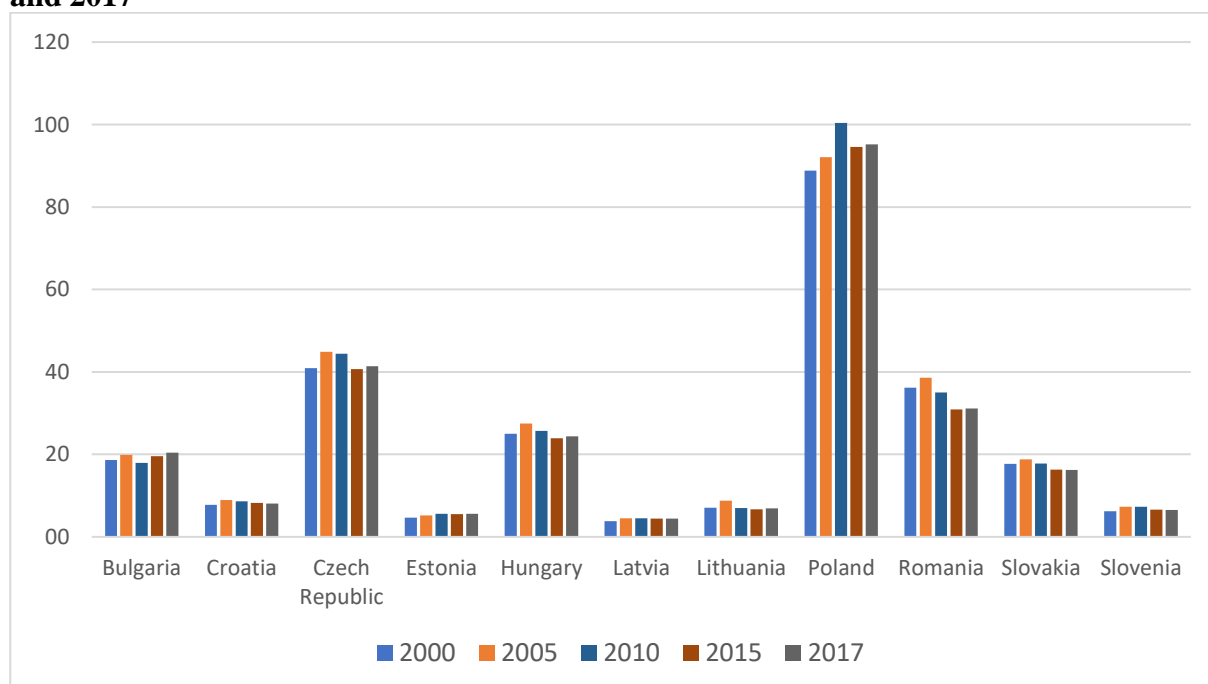
¹ On June 27th 2018, after five months of talks, Parliament and the Council reached an agreement on the revision of the renewable energy directive. The new target is 32% of renewable energy in final energy consumption, EU in 2030 instead of 27%.

² Additional, necessary investments are estimated at around EUR 270 million (corresponding to an average of 1,5% of the EU's annual GDP) over four decades [COM (2011) 112].

CEE region significantly increased the number of EU citizens by more than 92 million inhabitants. It expanded also the area of free flow of goods, people, services and capital. At the same time, it also contributed to further diversification within the EU, including the field of energy management. Admittedly, in accordance with treaty regulations (Article 194, paragraph 2) TFEU, Member States have the right to choose between different energy sources and create their own energy supply structure, taking into account own energy resources and economic interests, but should also respect common goals and rules as part of EU policy. In these countries significant economic and social changes took place as a result of economic transformation of the late XXth century and adjustments from the EU membership. Important challenges regarding the energy industry of the CEE countries constitute: the role in the energy industry in the country, domestic base of conventional energy resources and the energy infrastructure condition along with planned activities under the EU energy and climate policy. Therefore, below we are looking at: primary energy supply, share of fossil fuels in electricity generation, final energy consumption, greenhouse gas emissions and energy import dependence (solid fuel/ oil and petroleum and natural gas).

Among the countries in the CEE region between 2000 and 2017, Poland, the Czech Republic, Romania, Bulgaria and Hungary had the largest primary energy supply, while other countries, namely Slovakia, Croatia, Slovenia, Lithuania, Estonia and Latvia, were considerably smaller and accounted for around a quarter level of Poland's primary energy supply (Figure 1). In most countries, there is a slight decrease in primary energy demand since 2010.

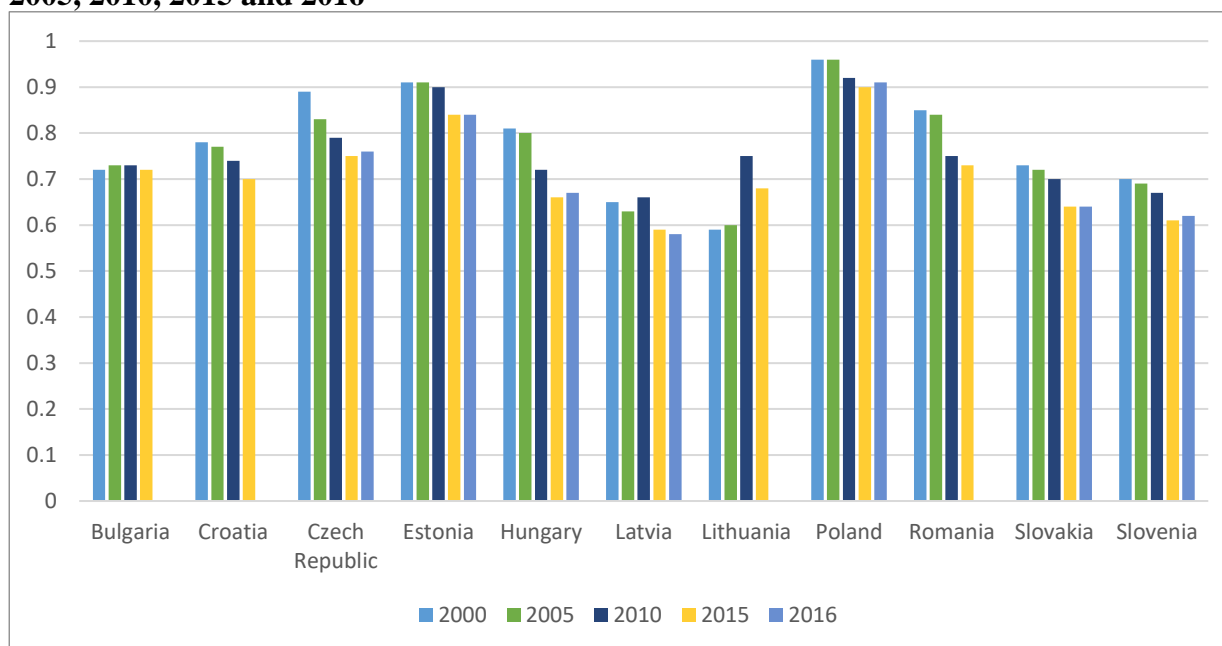
Figure 1. Primary energy supply (million toe) in selected countries in 2000, 2005, 2010, 2015 and 2017



Source: own elaboration based on Passport database

The gradual decline in demand applies also to fossil fuels, whose share in the primary energy balance is constantly high in all countries of the region and ranges from 60-90% (Figure 2). It is worth mentioning that in the category of fossil fuels there is not only coal, but also oil and natural gas. A relatively large drop can be observed in the analyzed period in the Czech Republic, Romania, Slovakia and Hungary. These, slow but positive, tendencies are accompanied by the increase in the use of renewable energy sources (Figure 3). Their development has been observed in many countries of the region since 2010, and the dynamics and volume of renewable energy used in Romania deserve attention, higher than in Poland in Bulgaria and the Czech Republic. In these countries, the energy of the sun, wind or water is used.

Figure 2. Share³ of fossil fuels in primary energy balance in selected countries in years 2000, 2005, 2010, 2015 and 2016

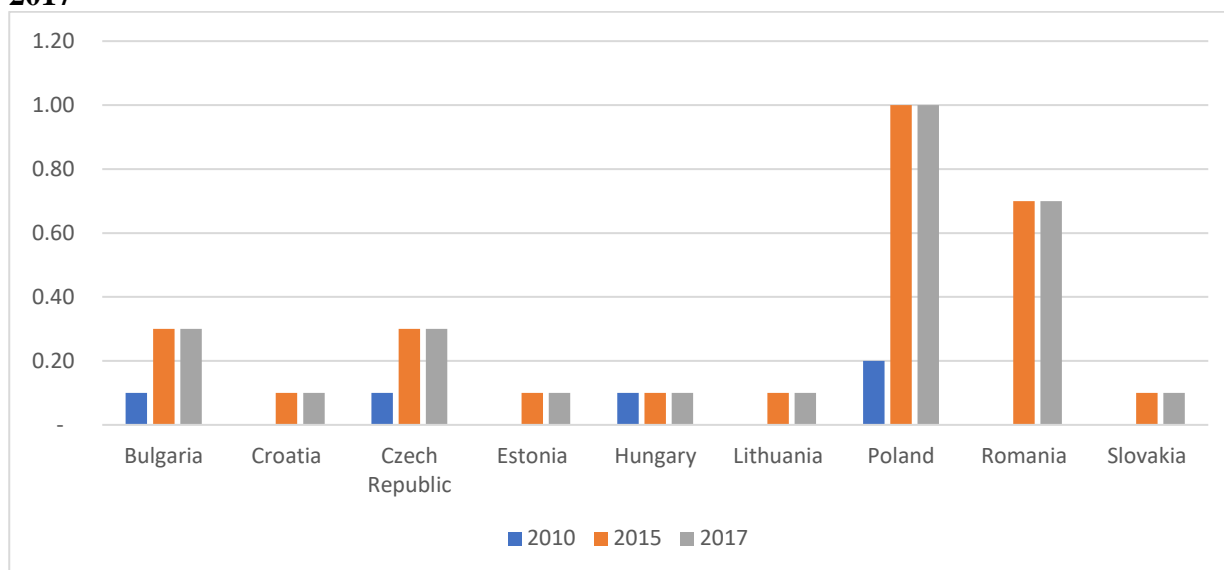


Note: Data for 2016 were not available for Bulgaria, Croatia, Lithuania and Romania.

Source: own elaboration based on OECD database

³ "Share" is given in accordance with the method of data presentation in the database from which the data originates. Therefore, in parts of the figures it is a range from 0 to 1 (or more than 1), while in others it is from 0 to 100 (more than 100).

Figure 3. Renewable energy production (mln toe) in selected countries in years 2010, 2015 and 2017*

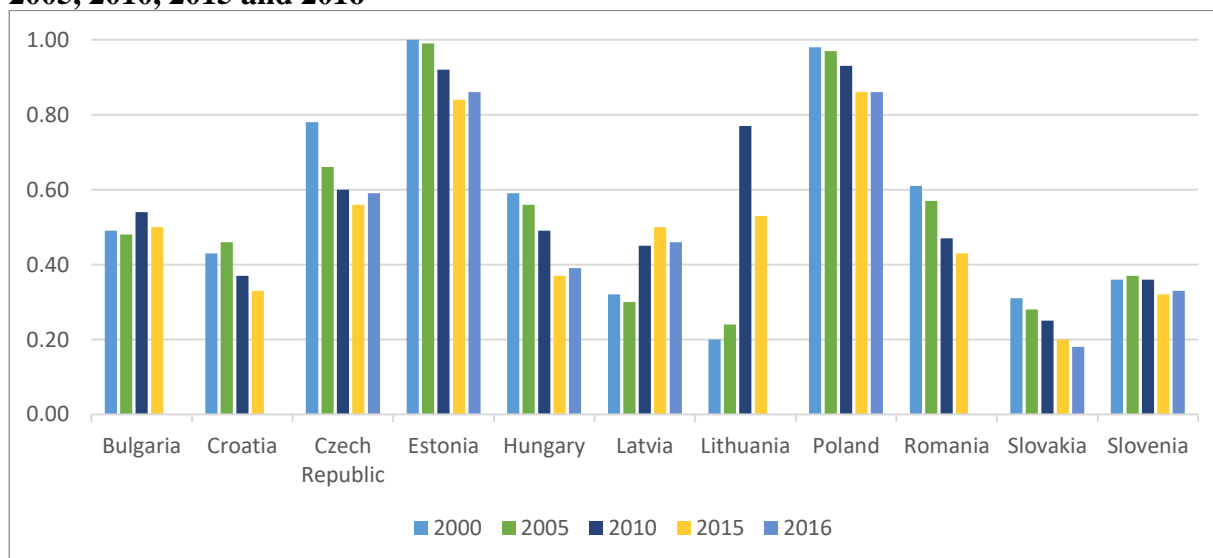


Notes: For Latvia and Slovenia data are missing for the whole period. Data for 2010 are not available for Croatia, Estonia, Lithuania, Romania and Slovakia.

Source: own elaboration based on Passport database

The balance of primary energy demand is related to the production of electricity. The structure of its production in the CEE region has been presented based on data on the share of fossil fuels in the production of electricity. When analyzing OECD data, it is clear that the countries of the discussed region are characterized by significant differences in the use of fossil fuels for the production of electricity (Figure 4).

Figure 4. Share of fossil fuels in the electricity generation in selected countries in years 2000, 2005, 2010, 2015 and 2016



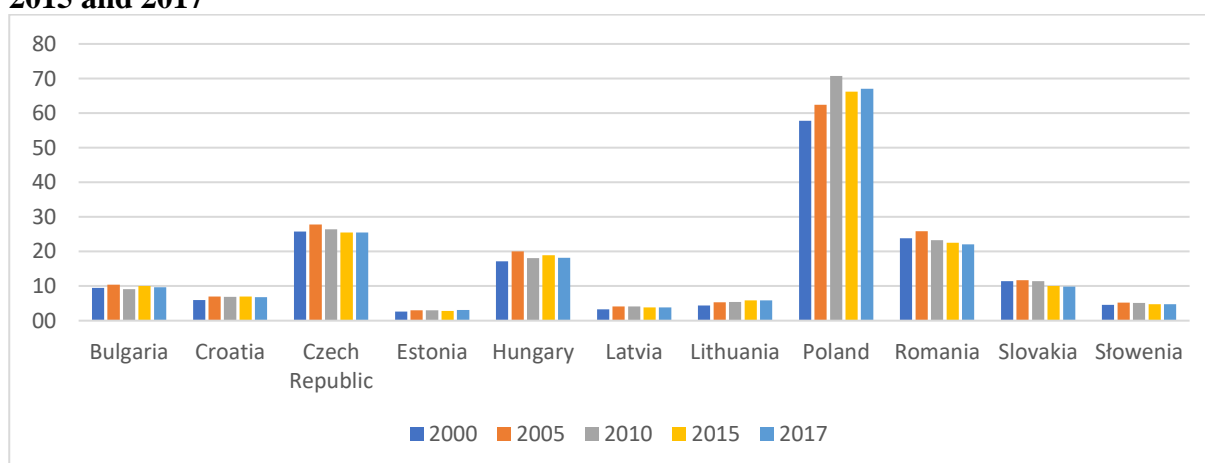
Note: Data for 2016 were not available for Bulgaria, Croatia, Lithuania and Romania.

Source: own elaboration based on OECD database

The largest share of fossil fuels in the generation of electricity is observed in Poland, Estonia and the Czech Republic. It is a result of the aforementioned domestic resource base. A significant increase in the share of fossil fuels in electricity production in Lithuania in 2010 resulted from the Ignalina nuclear power plant shut down and consequent increased use of natural gas. Analyzing the share of fossil fuels in the production of electricity in selected countries over the period 2000-2016, it is worth mentioning that similar trends can be observed at the CEE group level. In most countries, less and less electricity is produced from fossil fuels. An exception in the Central and Eastern Europe is Latvia, for which this share grew from around 30% in 2000 to around 50% in 2016. The high dynamics of changes observed for Lithuania results from the aforementioned change in the structure of electricity generation.

From a whole group of the CEE countries, Poland with energy consumption at the level of 95 million toe accounts for 6% of the total energy consumption in the EU amounting to 1626 million toe in 2015. The group of the largest EU energy consumers (2015) includes: Germany 314 million toe (19%), France - 253 million toe (16%), Great Britain - 191 million toe (12%) and Italy - 156 million toe (10%)⁴. The energy consumption in the CEE region in the analyzed period showed a downward trend. In comparison with 1990, the largest decreases were observed in 2015 in three Baltic countries, namely Lithuania (-57%), Latvia (-45%), Estonia (37%), but also in Romania (-44%), Bulgaria (-33%) (Eurostat, 2017b). With regard to final energy consumption, declines are less clear although they can be observed in the Czech Republic, Romania, Slovakia but also, although to a lesser extent in Poland (Figure 5). These trends are the result of processes of economies' restructuring as well as the effect of measures undertaken in the countries of the region with aim to increase energy efficiency.

Figure 5. Final energy consumption (mln toe) in selected countries in years 2000, 2005, 2010, 2015 and 2017

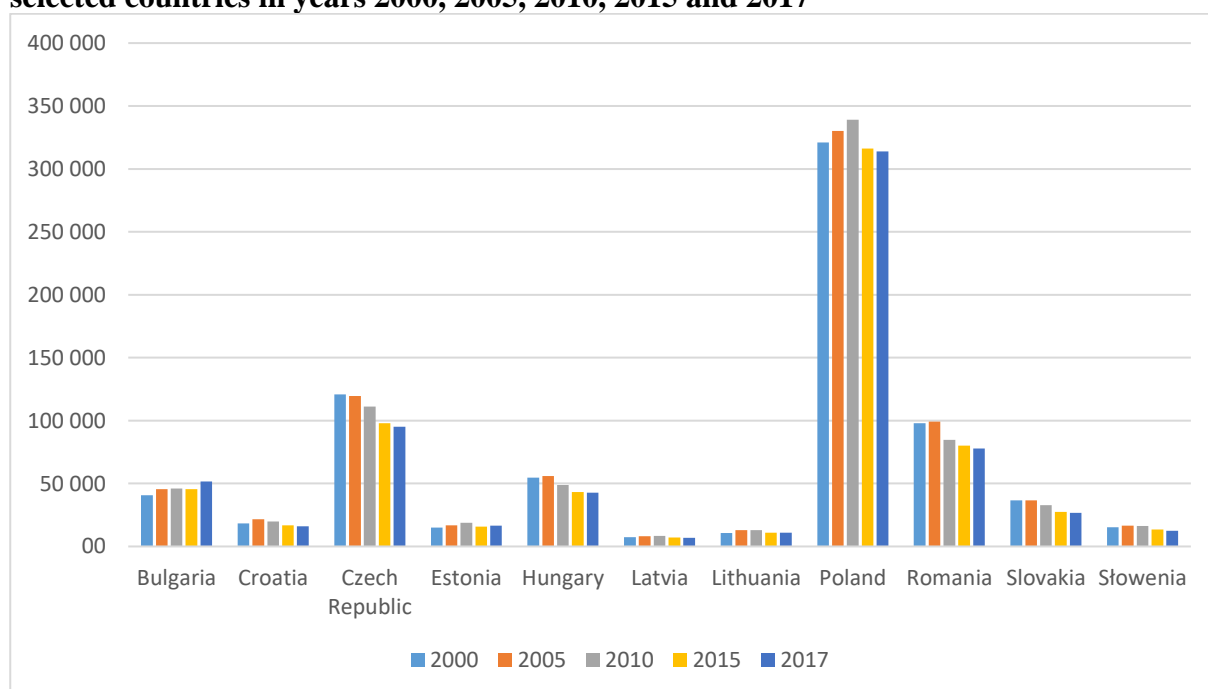


Source: own elaboration based on Passport database

⁴ Share in the total energy consumption in the EU.

Domestic resource base and its use consumption structure, with an extremely high share of solid fuels, significantly affect the amount of pollutants emitted to the atmosphere. The analysis of greenhouse gas emissions in the region's countries in the years 2000-2017, was conducted with the use of the Passport database and data covering greenhouse gas emissions from the energy industry (thousands of tons of CO₂ equivalents). It can be noticed that Poland represents the highest in the CEE group greenhouse gas emissions reaching more than 300 000 thousand tons of CO₂ equivalent. Incomparably lower emissions, oscillating around 100 000 thousand tons of CO₂ equivalent, were observed in the Czech Republic and Romania.

Figure 6. Greenhouse gas emissions from energy industry (thousand tons of CO₂ equivalent) in selected countries in years 2000, 2005, 2010, 2015 and 2017



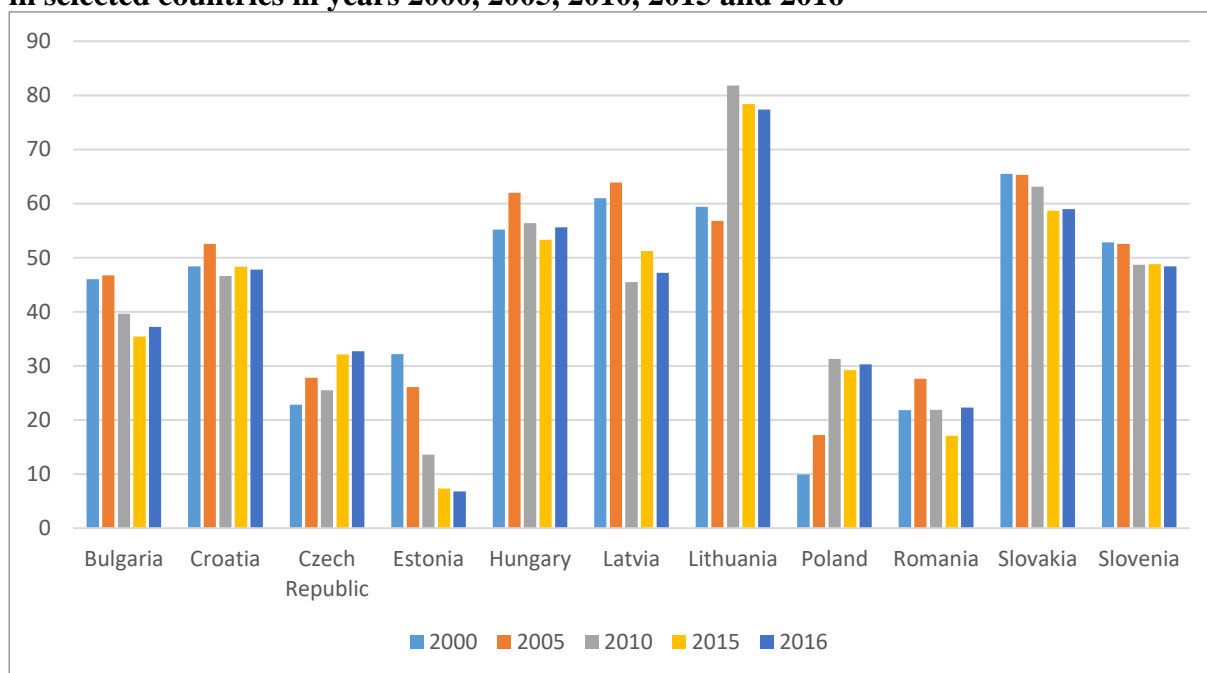
Source: own elaboration based on Passport database

Analyzing the GHG emissions from the energy industry over the years, it can be seen that all the countries of Central and Eastern Europe are characterized by a relatively constant level. Until 2007, the level of emissions seemed to be unchanged. It was only the economic crisis and the related reduction of industrial production that contributed to the reduction of greenhouse gas emissions. Apparently, this trend was visible in Poland, Romania and Bulgaria.

Due to insufficient domestic resource base, the countries of the Central and Eastern European region are forced to import deficit resources. In general, dependence on fuel imports is given as a percentage share of imported energy in total energy consumption. Analyzing such statistics for the group of discussed countries, it can be noticed that there are significant differences between individual states in this respect. At the EU-28 level, the share of imported energy in its total consumption in the

years 2000-2017 was stable and reached around 50%. Results of foreign energy imports dependence, significantly below this level, were recorded in the Czech Republic, Estonia, Poland and Romania. Other countries of the region were characterized by dependence on energy imports similar to the EU average (including Slovenia, Hungary) or higher (Lithuania).

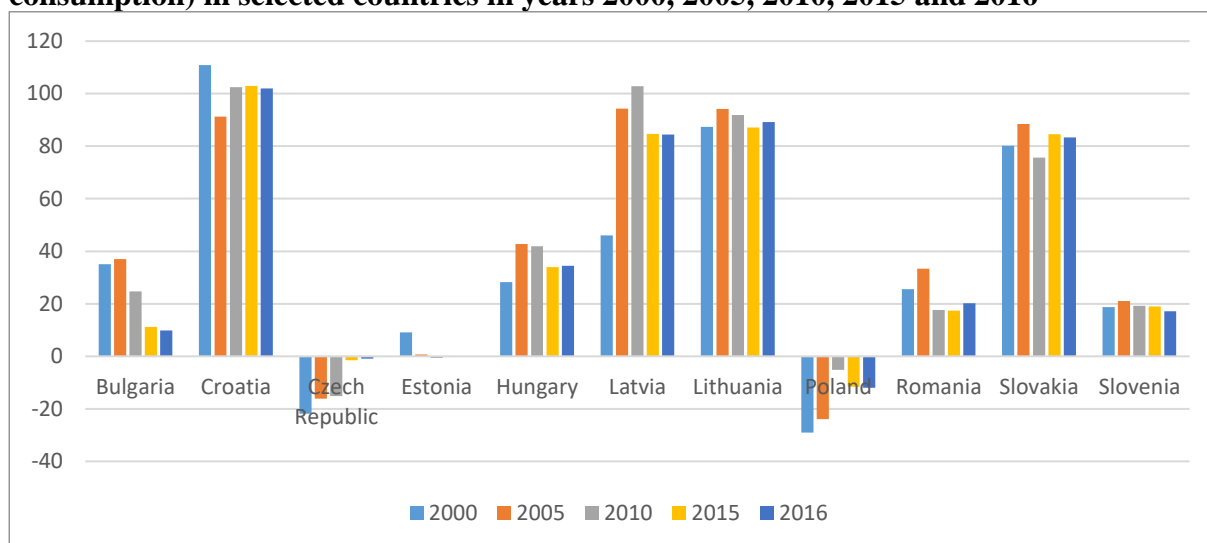
Figure 7. Energy import dependence (% share of imported energy in total energy consumption) in selected countries in years 2000, 2005, 2010, 2015 and 2016



Source: own elaboration based on Eurostat database

The dependence on energy imports in the case of Poland and the Czech Republic corresponds to the levels of their solid fuels' export (Figure 8). Both countries are one of the world's major exporters of coal. Over the years 2000-2016, it was observed that both in Poland and in the Czech Republic there was a reduction in coal exports related to competition from cheaper raw material from other countries. In turn, Croatia, Lithuania, Latvia and Slovakia are a group of countries in the region that cover almost all of the demand for solid fuels with imports.

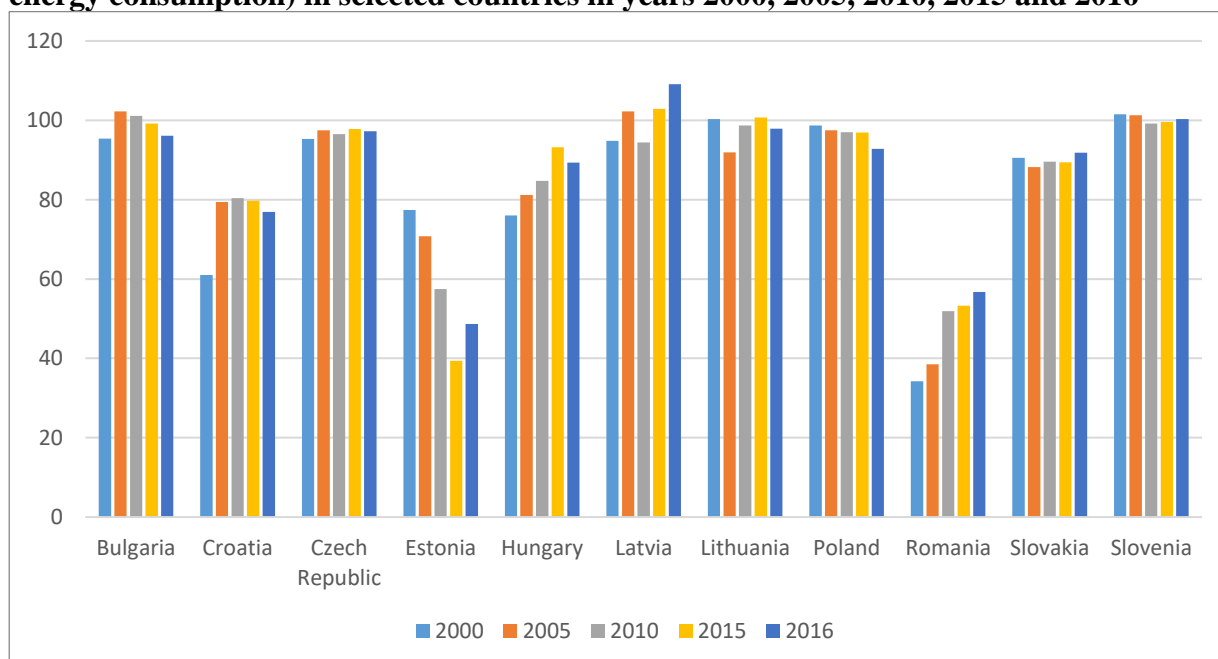
Figure 8. Solid fuel import dependence (% share of imported energy in total energy consumption) in selected countries in years 2000, 2005, 2010, 2015 and 2016



Source: own elaboration based on Eurostat database

In the case of crude oil (Figure 9), most of the countries in the discussed region covered almost all of the demand with imports from abroad. In this dimension, the countries of the region, in a degree higher than the EU average (EU-28), were dependent on import supplies. The exception in the group of Central and Eastern European countries is Estonia (unconventional oil) and Romania, which thanks to the national resources of crude oil are less dependent on the import of this commodity.

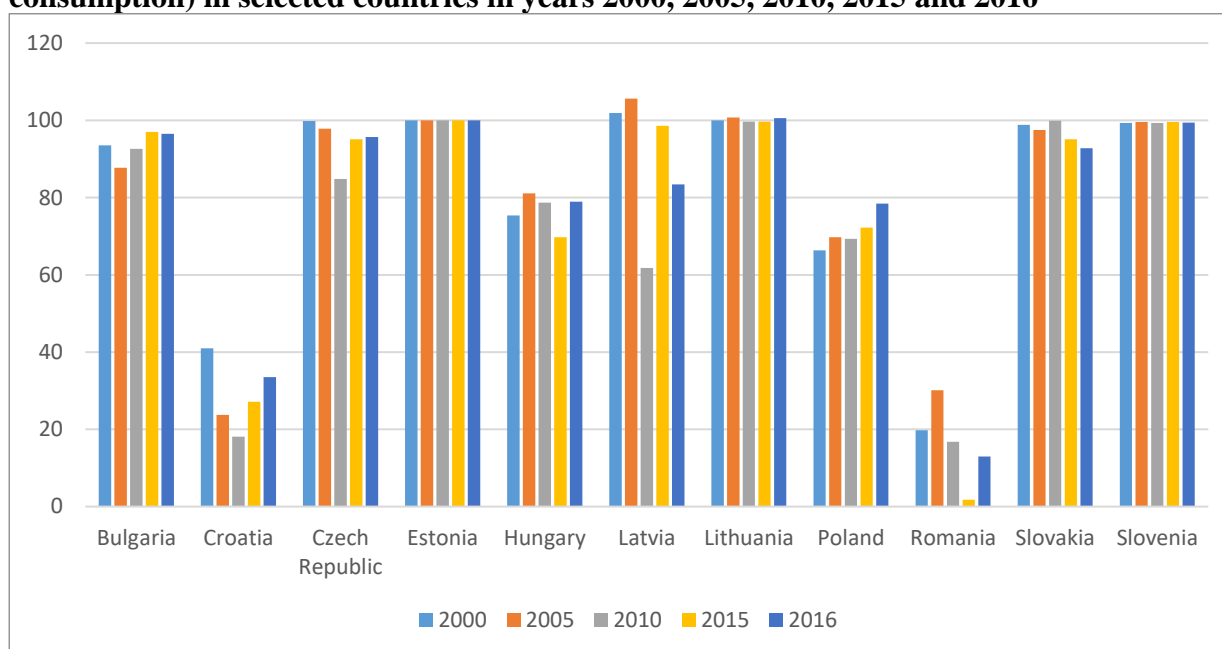
Figure 9. Oil and petroleum products import dependence (%share of imported energy in total energy consumption) in selected countries in years 2000, 2005, 2010, 2015 and 2016



Source: own elaboration based on Eurostat database

The CEE countries are more diversified in natural gas than in oil and petroleum products import (Figure 10). Natural gas import dependence is presented as the share of imports in total energy consumption. The majority of countries in the analyzed group is characterized by higher dependence on imported natural gas than the EU-28 average. In many countries, such as in Bulgaria, the Czech Republic, Estonia, Lithuania, Slovakia or Slovenia, almost all of this commodity comes from abroad. Countries that have a significantly better situation in imports of natural gas are Croatia and Romania. Both countries have a long tradition of natural gas extraction. Poland, compared with the countries of the region, stands out slightly higher than the EU-28 average dependence on natural gas imports.

Figure 10. Natural gas import dependence (%share of imported energy in total energy consumption) in selected countries in years 2000, 2005, 2010, 2015 and 2016



Source: own elaboration based on Eurostat database

Thus, the high fossil fuel dependence in the CEE region, including the growing dependence on their imports and CO₂ emissions, places these states in a difficult situation especially when facing the EU energy-climate policy challenges and the Community's desire to build a low-carbon economy in Europe by 2050. In order to assess the changes taking place in recent years in the CEE countries, we analyze and assess the progress in achieving the goals of the 3x20 package by 2020.

Analyzing the progress of countries from Central and Eastern Europe in achieving the climate and energy goals set for 2020, it can be seen that there is a group of leaders meeting climate-energy goals. That includes: Croatia, the Czech Republic, Estonia, Poland and Romania. These countries in 2016 reached the targets set for 2020 in limiting energy consumption, as well as in increasing above the target share of renewable energy in energy consumption (Table 1 in appendix).

It seems that a greater challenge for the countries of the region is the reduction the amount of energy consumed than increase in the RES consumption. In addition to Estonia in 2016, countries such as Croatia, Slovenia, Lithuania, Latvia and the Czech Republic also gradually reduced their final energy consumption. These are countries that in 2016 were less than 1 million toe from the 2020 target. An interesting observation delivers the case of Romania. This country was the only one who not only fulfilled the goals, but also reached the level of energy consumption significantly below the assumed threshold (about 8 million toe).

The analysis of the share of renewable energy in final energy consumption in 2016 shows, that most countries of Central and Eastern Europe have fulfilled their obligations in this area. The exceptions are Latvia, Poland, Slovakia and Slovenia. It is worth emphasizing, however, that these four countries are located around 2 to 4 percentage points (pp.) below the target. This means that its implementation in the perspective of 2020 is probable. Noteworthy is the situation of Croatia, which not only realized the target already in 2016, but also achieved 8 pp. "surplus" in relation to the 2020 target.

Regarding greenhouse gas emissions, including those from the energy sector, a downward trend can be observed in the analyzed period. However, for the countries of the region, the planned EU reduction target may be difficult to achieve. In 2015, only Estonia was closest to meet this goal and the gap amounted to 0,3 pp. (EEA, 2017, p. 23). For other countries, the gap was 8,5 percentage points for the Czech Republic; 8,4 pp for Poland; 9,2 pp. for Latvia; 12,6 pp for Lithuania; 13,3 pp. for Slovenia; and 17,6 pp. for Romania; 21,7 pp. for Bulgaria; 23,5 pp. for Croatia; 25,2 pp. for Slovakia and 28,6 pp. for Hungary.

The implementation of the targets of climate-energy package, the EU energy policy until 2030 and the long-term transformation of the EU economy towards a low-carbon economy requires a broad spectrum of activities through diversified instruments. Structural changes require significant financial resources for new investments in generation and storage capacities, energy technologies, energy infrastructure, including transmission and distribution. In 2014 alone, EUR 1,2 billion were allocated to low-carbon technologies under the 7th Research and Innovation Framework Program (Horizon 2020), and around EUR 4,2 billion under public investment and R&D programs in the Member States. Total investments in 2014 in the EU-28 amounted to approximately EUR 27 billion, and private sector investments accounted for 85% of their total value. In the long-term perspective, EU hopes to use the funds from the European Investment Bank, the TEN-E program, the European Fund for Strategic Investments, the European Economic Recovery Plan, the European Fund for Energy, Climate Change and Infrastructure 2020 and the funds available under the European Structural and Investment Funds

(eg. 'Connecting Europe'), funds from the European Neighborhood and Partnership Instrument and the Framework Program for Research and Technological Development.

Integrated Strategic Energy Technology Plan- SET-Plan (SET-Plan) is an important instrument to support science and research on energy technologies and their practical application. It contains 10 priorities, in particular related to: the integration of the European energy market, impact on energy supply, strengthened demand side management, efficiency improvement and achievement of energy and climate policy objectives (Wojtkowska-Łodej *et al.*, 2018). The plan assumes coordination of activities in the area of research between individual countries (including industry), identification of synergies between national research programs and priority areas of EU initiatives and activities.

In addition, an important issue in the EU is the increased financial commitment of Member States and the private sector along with the participation of stakeholders in all parts of the research and innovation chain.

Important issues strengthening solidarity between Member States and regional security of energy supply are new infrastructure connections of strategic importance for the EU (European Commission, 2017) and cross-border connections allowing free flow of energy resources within the single market. On June 22 (2018), the President of the European Commission J.C. Juncker and the heads of the Baltic States and Poland, agreed on a policy plan for the synchronization of power networks with the European continental network by 2025.

Energy security is one of the most fiercely discussed issues related to the energy industry (Nyga-Łukaszevska, 2018). Among many topics discussed there are also considerations regarding the impact of climate policy on energy security. Research showing climate policy-energy security link can be seen in the works of: Cherp *et al.* (2013); Jewell *et al.* (2013); Jewell *et al.* (2014); Guivarch, *et al.* (2015) and Guivarch and Monjon (2017). A common feature of all of these studies is the fact that ambitious climate policy goals impact the energy security.

When analyzing the situation of countries from Central and Eastern Europe, it can be noticed that the impact of the EU climate policy will have multidimensional effects on energy security. The most important consequence related to the implementation of the climate policy is the increase in the share of renewable fuels in primary energy balances. From the point of view of energy security, this is an objective that reduces the energy demand from import. It is distinctly visible that most of the countries in the discussed region, apart from Latvia, Poland, Slovakia and Slovenia, in 2016 met this goal. It is difficult to clearly determine what will be the impact on individual countries of the region, due to their significant dependence on the import of hydrocarbons. The dominance of crude oil and petroleum products in the transport industry on one hand, and restrictions on the dissemination of electric cars on the other hand, are not conducive to improving energy security in oil market.

Another important element from the point of view of energy security is the increase of energy efficiency, often called an additional "fuel" in the country's energy balance. Bearing in mind this feature of energy efficiency, through the more efficient use of energy, the demand for production and import of energy resources decreases. It seems with the course time the countries of Central and Eastern Europe, will have more difficulties to increase energy efficiency due to their energy situation.

The challenges from the point of view of energy security are to a certain extent targets related to greenhouse gas emissions. This is influenced by the fact that the majority of countries in the region are characterized by a high share of solid fuels in primary energy balances. Coal, both lignite and hard, belongs to the group of high-emission fuels. An additional threat to energy security in the region may be the increased consumption of renewable sources presented earlier. This applies in particular to the problem of instability of electricity production produced based on RES (so-called intermittency problem).

The analysis on the situation of the CEE countries proves that in general they are heading the same direction with climate-energy targets. Majority of them have either met selected the goals in 2016 or is close to meeting them. In both of the above given circumstances, CEE countries seem to perform well. Having these observations at hand it is be interesting to compare them with the situation of Germany representing one of the EU "founding members" and the strongest European economy.

In order to do that, authors compare progress in achieving the climate and energy targets set for 2020 between Germany and selected CEE countries. Germany is confronted with the best – Croatia and the worst - Slovakia CEE performer in the selected fields. Areas taken into consideration include targets in final energy consumption, RES share in final energy consumption along with GHG emissions. Countries are compared against their 2016 performance and their 200 targets.

Table 2. Progress of Germany in achieving the climate and energy targets set for 2020 with comparison to selected countries (2016 data)

Country/Target	Germany	Croatia	Slovakia
Final energy consumption (mln toe 2016)	216,4	6,6	10,4
Target: final energy consumption (mln toe) 2020	194,3	7	9
Target met: YES/ NO	NO	YES	NO
RES share in final energy consumption 2016 (%)	14,8	28,3	12
Target: RES share in final energy consumption 2020 (%)	18	20	14
Target met: YES/ NO	NO	YES	NO
GHG emissions (mln t of CO ₂ equivalent 2016)	410,9	14,2	19,7
Target: GHG emissions (mln t of CO ₂ equivalent) 2020	450,4	19,3	25,9
Target met: YES/ NO	NO	YES	YES

Source: own elaboration based on Eurostat database

It is clearly visible that Germany, compared to Croatia and Slovakia, definitely stands out in the scale of targets and actual energy statistics. That is particularly true in case of final energy

consumption and GHG emissions. Just to mention that Germany's GHG emissions are 10 times higher than those of Croatia, and final energy consumption is 20 times bigger than Slovakia's. Even though with RES targets numbers are comparable, due to their relative nature, in absolute numbers the role of renewables in the energy markets is incomparable. Differences in scale are an important feature as they might be regarded as one of the reasons for Germany's poor performance against CEE countries. Comparing Germany with Croatia it is visible that the latter met all the targets in 2016, while the former failed to do this in the same year. To eliminate Germany's discrimination against the best performer, we also compared it with the country from the CEE group, which recorded the weakest results with meeting targets. Slovakia failed to decrease final energy consumption and at the same time increase renewables share in energy structure (2016). However, the same country managed to decrease GHG emissions (in mln t of CO₂ equivalent) in 2016 to 19,7 mln t of CO₂ equivalent against 25,9 assumed as a target. Surprisingly, Germany underperformed with the climate-energy targets even when compared with Slovakia. Both countries had in 2016 similar relative distance to target in renewables share in final energy consumption, reaching in case of Slovakia 2 pp and 3,2 pp in case of Germany. The scale difference between those two is clearly visible in the final energy consumption. Even in relative numbers Slovakia is around 16% behind the target and Germany 11%, for the former that means reduction in energy consumption by ca. 1,4 mln toe and for the latter ca. 22,1 mln toe.

Such situation brings into the light the question of motivation for the CEE countries in reaching climate-energy package especially when they are compared with the European economic superpower, such as Germany. Additionally, strong divergence between CEE countries and Germany in achieving climate-energy package targets might be a proof that new Member States have already picked up "low hanging energy fruits" resulting from their economies transformation.

Conclusions

The long-term changes of the EU economy towards a low-emission economy, made on the basis of a common EU energy policy⁵, were expressed in the Lisbon Strategy, climate policy up to 2030 and long-term low-emission development strategy until 2050 and confirmed in the Energy Union concept (Wojtkowska-Łodej *et al.* 2016, pp.11-41). In order to meet the long-term challenges, financial and institutional support systems have been established at the European level. However, it

⁵ The objectives of EU energy policy are set out in art. 194. paragraph 1 of the Treaty on the Functioning of the European Union (TFEU), and include: ensuring the functioning of the energy market, ensuring security of supply in the Union, promoting energy efficiency and energy savings, as well as developing new and renewable forms of energy, and supporting interconnections between energy networks. At the same time, it is stated that cooperation between Member States is to be sowing the spirit of solidarity and taking place as part of the establishment or functioning of the internal market and taking into account the need to preserve and improve the natural environment.

is worth mentioning that the individual Member States will be of key importance while introducing the strategy goals in the EU energy industry.

EU actions towards the transformation of the energy economy have begun the process of real changes taking place throughout the EU. These activities also provide opportunities for structural economy changes and boosted development of the CEE region countries. The process of structural changes in the economies of the CEE countries towards low-carbon economies has begun, as evidenced by positive trends in the implementation of the objectives of the energy-climate package, but in the long-term it is a significant development challenge for these countries. Implementation of increasingly ambitious climate policy goals may be a challenge to the CEE countries due to their large dependence on energy production from fossil fuels and the transformation of economies in the 1990s. Ambitious climate policy goals have an impact on energy security in the CEE region. This applies both to the structure of energy supply, but also to the way it is used. Majority of countries converge with achieving the goals. They are achieving or close to achieving goals set in the climate-energy strategy. The group of leaders include: Czech Republic, Croatia and Estonia. In the face of new challenges related to the transformation of energy industries in the countries of the region, the financial commitment of the Member States (in addition to EU support) and the private sector will be important. It includes also the participation of stakeholders in all parts of the energy research and innovation chain. Comparing CEE countries with Germany proves that countries are strongly diversified in meeting their goals. Germany performs worse than other CEE economies with achieving goals, however reasons responsible for this might be on one hand difference in scale of German economy and CEE countries and on the other economic transformation Central and Eastern Europe states experienced in the 1990s. If so, CEE countries will face greater challenges with meeting more stringent future goals.

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Table 1. Progress of EU Member States from the Central and Eastern Europe region in achieving the climate and energy targets set for 2020

Region	Final energy consumption (mln toe 2016)	Target: final energy consumption (mln toe) 2020	Target met: YES/ NO	RES share in final energy consumption 2016 (%)	Target: RES share in final energy consumption 2020 (%)	Target met: YES/ NO
Bulgaria	9,7	8,6	NO	18,8	16	YES
Croatia	6,6	7	YES	28,3	20	YES
Czech Republic	24,8	25,3	YES	14,9	13	YES
Estonia	2,8	2,8	YES	28,8	25	YES
Hungary	17,9	14,4	NO	14,2	13	YES
Latvia	3,8	4,5	YES	37,2	40	NO
Lithuania	5,1	4,3	NO	25,6	23	YES
Poland	66,7	71,6	YES	11,3	15	NO
Romania	22,3	30,3	YES	25,0	24	YES
Slovakia	10,4	9	NO	12,0	14	NO
Slovenia	4,9	5,1	YES	21,3	25	NO

Source: own elaboration based on Eurostat database