Positive energy practice in Lubuskie District - a case study

J Zarębska¹, A Zarębski², J Adamczyk³

¹, ³ University of Zielona Góra, Faculty of Economics and Management, Podgórna 50, 65-246 Zielona Góra, Poland.
² Maritime University of Szczecin, Faculty of Marine Engineering, Wały Chrobrego 1-2, 70-500 Szczecin, Poland.

E-mail: j.zarebska@wez.uz.zgora.pl

Abstract. In this article “Zielona Góra” Public Power Utility EDF Group (EC) is the first to have abandoned production of electricity and warmth on the basis of coal mine and introduces natural gas. Investing in oil and gas boilers was the revolution in the company and a good example of positive energy and environmental practice. The use of new and less emissive materials (natural gas, heating oil) in the production also affects the local society and the city itself. Following “Zielona Góra” Heat and Power Plant, another institution introduces the clean technology. It is PGE Plant in Gorzów Wielkopolski for which a gas and steam block was put into operation. It has ensured energy independence in Lubuskie District. The aim of the article is to present the comparative LCA of energy production which is a tool of environmental resource management in enterprises in microeconomic terms. In macroeconomic terms it can be the element of the energy policy in a region or even a country. Achieved by the largest EC in the district an ecological effect is compatible with National Spatial Development Concept 2030 and other strategic documents determining the framework of economic, social and environmental development of the district.

1. Introduction

According to assumptions of the sustainable development, changing into cleaner technology by the public power utility, a bigger variety and the safety insurance of the supply are the requirements of our times. Along with the growth of the environmental pollution resulting from the energy and warmth production (which is the consequence of the demand for these products) can be observed that negative influence on the environment is being limited with the use of new and innovative methods. Not only has such actions as a good practice a positive economic and ecological echo but also has social resonance and is compatible with the aims of the Polish Energy Policy by 2050 (PEP50) and Integrated Product Policy (IPP).

The aims of the IPP are to improve the effectiveness of the renewable and nonrenewable resources (especially for energy goals), to manage better materials, energy and waste, to limit the pressure on the environment and to lead to sustainable development along with the consumption at a high pace of the economic growth [1]. The fundamental tool of the IPP is Life Cycle Assessment (LCA) which enables to mark and compare the influence of different ways of energy production on the environment. LCA as a technique is based on the ISO 14040. In view of the growing meaning of the issues connected with the energy influence on the environment and the related costs, the authors of the present article present LCA results for EC “Zielona Góra” for an old technology (coal mine) and a new one (natural gas). What is more, a cohesion analysis is made. It involves the analysis of the energy policy of the
two biggest heat and power plants in Lubuskie District (EC „Zielona Góra” S.A. Grupa EDF and EC PGE Gorzów Wielkopolski) along with the strategic documents presenting the frames of the economic, social and environmental development of the district (e.g. National Spatial Development Concept 2030 – pol. KPZK2030, Strategy for Energy Security and Environment, Spatial Development Plan for Lubuskie District – pol. PZPWL).

2. Polish Energy Policy

“Polish Energy Policy till 2050” (PEP50) is a part of system managing country development based on “Long-term strategy of country development”, “Medium-term strategy of country development”, “National Spatial Development Concept 2030” and nine integrated strategies (including: “Energy and Environment Safety Strategy”). The main aim of PEP50 is creating conditions for constant and sustainable development of energy sector which leads to economic development, energy safety and energy supply for industries and households. To achieve the goal there are three operational objectives: 1) ensuring the energy safety of the country; 2) enhancing the competitiveness and economic energy effectiveness in the frames of inner energy market of the EU; 3) limiting energy influence on the environment [2].

Despite the EU's policy to reduce the competitiveness of coal installations, the objectives of the PEP50 are primarily to be achieved through the use of domestic hard coal and lignite resources. Natural gas and crude oil are mainly external raw materials whose availability is ensured, in particular, through existing transport infrastructure (gas terminal in Świnoujście, oil terminals, pipelines). It is also assumed to increase the efficiency of obtaining biomass for energy purposes and create conditions for the creation of new sources of biomass, with particular emphasis on the local character of this fuel.

The biomass itself will not, however, provide the EU targets for renewable energy (pol. OZE) energy consumption in the EU at 27% by 2030. It is therefore expected to provide at least 10% of OZE in transport fuels and 15% primary energy.

The project of sustainable energy policy of Poland by 2050 assumes the development of the National Energy System (pol. KSE) and investments in six directions: CO₂ reduction (EU plans 40% reduction of CO₂ emissions by 2030), clean coal technologies (pol. CTW), smart grids, energy storage renewable energy technologies (OZE), energy for waste management and for the elimination of "low emissions", carbon block elasticity and extending vitality of old blocks, and broadly understood computerization [3, 4]. These plans are to be realized by continuing the current trends and implementing the decisions taken in the field of development of the country's energy sector. This is due in large part to the need of investing in the mining sector, thereby improving the efficiency of existing production, restructuring existing assets and starting new coal deposits (possibly using new mining technologies).

In addition, two auxiliary scenarios are assumed, in which [2]:
1) nuclear scenario - predicts the dominant role of nuclear energy in the energy balance of Poland (to about 45-60%), natural gas from unconventional deposits of about 10-15%, renewable energy production of about 15%, and coal and lignite 10-15%;
2) Gas + OZE scenario - based on the assumption of a large-scale launch of large-scale natural gas extraction in Poland from unconventional deposits and OZE in the primary energy balance at a total level of 50-55%. The supply structure of the gas fuel market will be balanced and diversified by: significant development of domestic production, gas port in Świnoujście, Yamal-Europe gas pipeline, interconnectors. In this scenario, the share of coal and lignite energy should be reduced to 30% while crude oil would reach 15-20%. The gas scenario assumes the use of OZE at about 20% and nuclear sources at about 12%.

Both scenarios are long-term projects and may prove to be unrealistic, even if Poland's further withdrawal from the construction of a nuclear power plant (as was already the case in Żarnowiec and Klempicz - EJ Warta), for the construction of further coal blocks (planned construction of the Ostrołęka Power Plant C with a capacity of about 1,000 MW) [5]. Moreover, with the current state of development of OZE technologies and electricity storage technologies, it is difficult to consider the
expansion of OZE in the primary energy structure without the simultaneous development of stabilizing sources (such as hard coal).

A serious impediment to sustainable and diversified (i.e. Energy mix) development of domestic energy devices are outdated electricity generating and transmission lines. As reported by the National Power System, at the end of 2013, the electric power of the system was over 38 GW. Approximately 95% of this power was installed in power plants, with the dominant power plants being coal and lignite fired (29.4 GW). The total length of power lines in Poland in 2013 was about 830 000 km, of which more than 30 years had 80% of 220 kV line, 23% of line 400 kV and 38% of transformers. Over 30 years also has about 59% of electricity turbines, and over 20 years - about 16% of turbines. The remaining 25% of the manufacturing facilities are younger ones, with only 6% of the devices running in the last 5 years. As the expected lifetime of coal blocks is 40-45 years, power capacity is expected to be around 6.4 GW by 2020 and replaced by 6.5 GW. To renew existing energy potential by 2030, a power plant of at least 10-12 GW would be required [2]. In the document of the Office of Electronic Communications (pol. UKE) and the Energy Regulatory Office (pol. URE) entitled "A collection of good practices in cooperation with the telecommunications and energy sectors" [6], we also note that for the KSE it is necessary to "implement, in the next few years, a significant investment in infrastructure (...) to create high quality, modern telecommunication and electricity networks while reducing the costs of these investments, the total time it takes and reducing the nuisance to the local community".

The PEP50 project may face further obstacles due to EU changes in the so-called "Winter package". The National Chamber of Commerce (pol. KIG) points out that according to the "Winter Package" [7] the share of renewable energy sources in the power mix at 27% in 2030 is to be increased at EU level but not in Poland at the proposed mechanism penalties for countries that do not fulfill their obligations by 2020. A similar situation applies to the exclusion of biomass burning to generate electricity in installations above 20 MW from the list of OZE technologies. In addition, the proposal to introduce a new emission standard below 550grCO₂/kWh for power markets is a serious threat to Poland's energy security. KIG emphasizes that the EU proposals contained in the "Winter Package" do not guarantee the reliability of energy supply at competitive prices, and this is the basis for the development of the energy market. Moreover, the introduction of EU network codes and distribution operators cannot guarantee the respect of the rights of the Member States, the powers of national regulators in the area of ensuring the stability of the KSE and, in particular, the decision on the balancing of reserve power.

3. Positive economic practice EDF Poland Group

Positive practice is an innovating action which brings specific and positive results. It is also permanent, repetitive and can be used in similar conditions in other places or by other institutions (companies, subject services etc.). In case of energy sector positive practice is all actions aiming at claiming the sustainable development, enhancing competitiveness, effectiveness and energy safety of the country along with limiting the energy influence on the environment.

In comparison of positive practice in 2016 [8] we can see that there is no particular growth of positive practice in national industry. In a previous year only 454 practice were noticed and the main areas were ‘environment’, ‘consumer issue’. In the area of environment 72 initiatives of good practice were noticed (mainly in ecological education, biodiversity-energy sector, sustainable architecture - offices, shops, factories). The bad condition of the air, pollution, climate change are the main inspirations of good practice in energy sector. EDF Poland is one of the examples of such positive actions. The Group in Cracow with the co-operation with the City Hall promotes network heat and municipal water heat, endowment to building inner heating installation for coops. It also offers formal help e.g. along with a distributor help in incorporating buildings with a coal heating to city network heat. The result: 5590 applications for close-down of 8490 furnaces and carbonic boilers. What is more, EDF Poland in their heat and power stations has introduced desulphurization installations and fumes denitrification as pro-environmental investments. It also helps with payments for the heat bills.
of poor citizens (Cracow, Toruń, Tri-city, Wrocław, Siechnice, Zielona Góra). In 2016 the help was 385 thousand PLN. Furthermore, EDF Poland encourages disabled sportsmen, women professional development, safety of biodiversity and it has noticed threefold decline in accidents.

Apart from positive practice in social, environment issues, actions in ecological education, especially the protection of atmospheric air are very important. Unfortunately, as the studies show “most of detached houses in Poland is equipped with boilers of low energy effectiveness. Boilers are mainly heated with the used solid fuel of low quality. Other often used procedure especially in smaller towns depends on burning municipal waste such as plastic, textiles, india rubber” [9]. Not only is it prohibited but it is also dangerous to people’s life and health. What is more, it impoverish the quality of atmospheric air.

4. Positive Energy Practice in Lubuskie District – a case study

Lubuskie District is in western Poland. It borders with West Pomeranian District (on the north), Greater Poland District (on the east), Lower Silesian District (on the south) and Germany (on the west) – Figure 1. Its total area is 13988 km² (4.47% of the country area). One of the main characteristics of the district is that there are two capital cities: Zielona Góra (the seat of the elected regional assembly) and Gorzów Wielkopolski (the seat of the centrally appointed voivode or governor). There are 1018075 citizens (2.7% of the populace in the country) and the density is low - 73 people/ km² (the mean for Poland is 123 people/km²). The biggest huddles are capital cities: Gorzów Wielkopolski – 123762 and Zielona Góra – 138711 citizens (status - 31st December 2015). In terms of area Zielona Góra has 277 km² and Gorzów Wielkopolski has 86 km² [10, p. 7-8].

Figure 1. The location of the Lubuskie Province in Poland [11].

The district is rich in natural qualities such as varied landscape, picturesque lakes and rivers, forest complex. It has got the largest forest cover in the country (49%). Furthermore, the area of the Lubuskie District is high in different mineral resource, e.g. natural gas, helium, oil, mine coal, copper ore, silver, sulphur, clay ceramic stoneware, fireclay and raw material [10, p. 9]. Despite so many natural values, the Lubuskie district suffers from anthropogenic air pollution resulting from human activities. Natural processes occurring in nature (natural emissions) are of marginal importance. Anthropogenic emissions include emissions from industrial and power plants, i.e. low emission from municipal management (boiler houses, individual fireplaces and private craft business) and transport emissions. It is hard to estimate the size of this emission. It oscillates between a few and a dozen or so percent of total emissions in areas with a developed heating network (currently it is the city of Zielona Góra and Gorzów Wielkopolski) and up to several dozen percent - in areas that do not include central heating systems, especially in rural areas. The increase in concentrations of gaseous pollutants and
particulate matter (PM) occurs in the heating season, usually covering the period from mid-September to the end of April the following year.

Air quality evaluation and activities resulting from them are referred to areas called zones in accordance with the Regulation of the Minister of the Environment of August 2, 2012 on zones in which air quality is evaluated [12]. Lubuskie District is divided into three zones: the city of Górze Wielkopolski – 123,911 inhabitants; the city of Zielona Góra – 138,898 inhabitants; lubuska zone – 754,641 inhabitants. According to the art. 89 of the Environmental Protection Law [13], the level of substances in the air in a given zone is evaluated every year, and then the zones are classified in different levels: class A- means not exceeding the admissible level, class C - above the admissible level (taking into account the permitted frequencies exceedances specified in the Regulation of the Ministry of the Environment on the levels of certain substances in the air). Table 1 presents the admissible levels applicable in the annual air quality assessments for SO₂, NO₂, C₆H₆, CO, NOₓ, PM10, B(a)P, ozone and Pb dust contained in PM10 - assessment in terms of health and plant protection.

Table 1. Admissible levels in annual air quality assessments for selected gaseous and particulate emissions - evaluation in terms of health and plant protection [13,14].

| The name of the substance | The period of averaging the measurement results | Admissible level of substances in the air | Admissible frequency of exceeding the admissible level in a calendar year |
|---------------------------|-----------------------------------------------|-----------------------------------------|-------------------------------------------------------------------|
| benzene C₆H₆              | a calendar year                               | 5 μg/m³                                 | -                                                                |
| nitrogen dioxide NO₂      | an hour (1h)                                  | 200 μg/m³                               | 18 times                                                          |
|                           | a calendar year                               | 40 μg/m³                                | -                                                                |
| nitrogen oxides NOₓ       | a calendar year                               | 30 μg/m³                                | -                                                                |
| sulphur dioxide SO₂       | an hour (1h)                                  | 350 μg/m³                               | 24 times                                                          |
|                           | 24 hours (24h)                                | 125 μg/m³                               | 3 times                                                          |
|                           | a calendar year and winter time (1 X-31 III)  | 20 μg/m³                                | -                                                                |
| particulate matter PM2,5 | a calendar year                               | 25 μg/m³                                | level till date of January 1, 2015                               |
|                           |                                               | 20 μg/m³                                | level till date of January 1, 2020                               |
| particulate matter PM10   | 24 hours (24h)                                | 50 μg/m³                                | 35 times                                                          |
|                           | a calendar year                               | 40 μg/m³                                | -                                                                |
| carbon monoxide CO        | eight hours (8h)                              | 10000 μg/m³                             | -                                                                |
| benzo(a)pyrene C₂₀H₁₂     | a calendar year                               | 1 ng/m³                                 | -                                                                |
| ozone O₃                  | eight hours (8h)                              | 120 μg/m³                               | 25 days                                                          |
|                           | vegetation period (1 V-31 VII)               | 18000 μg/m³                             | -                                                                |
| lead Pb                   | a calendar year                               | 0,5 μg/m³                               | -                                                                |

According to the Statistical Office, in 2015, dust emissions in the Lubuskie district from plants classified as particularly burdensome amounted to 0.9 thous. Mg (tons), which accounted for 2% of the total mass of emitted dust pollution in Poland. The major problem in air pollution in Lubuskie district is the high concentration of PM10 and the benzo(a)pyrene – B(a)P in it exceeding the permissible and target levels specified by the law [12-17]. The largest source of particulate matter emissions PM10 is surface emission (62.5% - municipal and living sources) - 5949 Mg / a year, the smallest agriculture - the sum of emissions from the area of meadows and pastures - 24.5 Mg / a year. In the case of benzo(a)pyrene, the most important emission source (80.8%) is the surface emission.
from communal-living sources of 2,842 Mg / a year and the point emission of 0.6698 Mg / a year, while the smallest source of B(a)P emission is a linear emission - from transport (from county and commune roads) 0.00023 Mg / a year [18 p. 18] – (see Figure 2).

![Image of particulate matter emissions PM10 distribution](image_url)

**Figure 2.** Distribution of particulate matter emissions PM10 with a division into emission types and sizes in individual counties of Lubuskie District [18 p. 19].

The volume of gaseous emissions in 2015 reached the level of 2000.1 thousand Mg (tons), which was 0.9% in relation to the total amount of emitted gases in Poland. The results of modeling concentrations of PM10, PM2.5, SO2, NO2, B(a)P for the annual air quality assessment for 2016 for
Lubuskie District confirmed that there were no exceedances of limit values in the air: sulfur dioxide (11-36 μg/m³ for max 24h concentration of pollutants), nitrogen dioxide (6.68-22.58 μg/m³), benzene (0.59-0.60 μg/m³), carbon monoxide (1543-2762 μg/m³, S8h maxD measurement – maximum eight-hour average, of rolling average, calculated from eight one-hour averages over a 24-hour period). Due to the above, all zones of the Lubuskie District are classified in Class A.

In 2016 the target level for ozone (O₃) was also exceeded (8h maxD - 120 μg/m³). Significant impact on the ozone target exceeded was 2015, which was unusual at the meteorological level. The zone of Lubuskie District (without the city of Gorzów Wielkopolski and Zielona Góra) is classified in Class C, which means it is recommended for the implementation of an air protection program to protect human health and the protection of plants and animals [18 p. 76].

In cities and areas of high traffic routes, an increasing problem, due to the emission of pollutants into the air and noise emission, is car communication (over 580,000 passenger cars, out of which as much as 85% are cars with 10 years and above). As a result of fuel combustion in car engines (58% petrol cars, 30% - gas oil cars, 11% - LPG cars), gaseous pollutants enter the atmosphere: nitrogen oxides (NOₓ), carbon monoxide (CO), carbon dioxide (CO₂) and aromatic hydrocarbons (especially benzene) and dust containing, among others, compounds: lead, cadmium, nickel and copper [18 p.14-18]. The effect of NO₂ linear emission on the concentration values within the main roads running through the Lubuskie District (A2 and A18 motorways and S3 carriageway as well as main roads, especially DK18 and DK32) is clearly visible - Figure 3. In places the emission level is over 30 μg/m³, which does not exceed the admissible standards. The increase of transport pollution is also influenced by the fact that Lubuskie District, is a transit area for cars crossing the Polish-German border (Warszawa-Poznań-Berlin). The combination of pollutant emissions resulting from car communication along the S3 road (Szczecin, Gorzów Wielkopolski, Świebodzin, Zielona Góra, Nowa Sól and further Wrocław) with local emissions may be a very big problem in a few years. The reason for anxiety is the continuous increase in the volume of car communication and still functioning (in the heating period in urban areas) coal-fired furnaces - see Figures 2 and 3.

![Figure 3. Lubuskie District: a) the layout of carriageways (A-2, A-18, S-3), b) modeling result for nitrogen dioxide, taking into account average annual values in terms of health protection - 2016 [18 p. 33; 19].](image-url)
Zielona Góra and Gorzów Wielkopolski district center", the third priority is "to develop a competitive economy, among other things through (...) the development of a low-rational management of mineral deposits, development of energy infrastructure and environmental protection" [20 p. 10-11]. Problems related to excessive air pollution, especially low emission, are described not only in provincial documents, but above all in national plans and strategies ("The Concept of Spatial Land Development 2030") adopted in December 2011 - the so-called KPZK2030 "Energy Security Strategy And Environment"). The main aim of all these documents is to quickly improve the environment and protect the inhabitants of the region (district) from pollution, but also to strengthen Poland's resilience to energy security threats (e.g. by building energy links with neighboring countries) and diversifying energy sources (increasing the generation of energy from renewable sources - by 2020 at least 15% of the final gross energy consumption) [21 p. 151; 22 p. 31-44].

As an example of implementing the assumptions of the air protection program in the Lubuskie District and good energy practices, there may be two large investments in the area of Zielona Góra and Gorzów Wielkopolski. Both investments involve the conversion of CHP and change of source of raw material.

Heat and Power Plant "Zielona Góra" S.A. the EDF Group was the first company in Poland to completely abandon its production of electricity and heat on the basis of hard coal (CB), and has since been converted to natural gas (nitrified gas) from the Kościan-Brońsko mine by a gas pipeline 300/350 mm in diameter and 100 km in length. The installed electric power in 2014 was 198 MWe (gas-steam block - GSB) and the installed capacity was 135 MWt (gas-steam block) and 167 MWt (oil-gas boilers). The heat generated by the EC heating system is transferred to the heating system of the city of Zielona Góra and the electricity to the national power system. Investment in steam and gas blocks was a revolution in the company and an example of good environmental practice. The use of a new, less energy-intensive raw material for energy production has also had an impact on the externalities of the local community and the city as a whole [23, 24].

In Heat and Power Plant PGE Gorzów Wielkopolski, its latest investment, estimated at net PLN 562 million, ended in February 2017 (although the first gas turbine was launched in 1999). The gas-steam block (GSB) has a power of 138 MW of electricity and 100 MW of heat. Overall net efficiency in cogeneration work, at full load, is 83.93%. The new installation partially replaced the existing, used infrastructure using coal as a fuel. The new unit is based on two SGT-800 gas turbines and one SST 400 steam turbine with complete electrical system and control system. PGE Gorzów Wielkopolski is the only recipient of gas supplied by the gas pipeline from the BMB mine near Dębno Lubuskie (nitrogen-rich gas) [20, 25].

The above investments, due to the change of fuel and expansion of their activities, were aimed at reducing local low emissions, improving the environment and human health. For comparison, before introducing the investment in 2000, air pollutants were at levels (for max 24h pollutant concentration): for sulfur dioxide 5-27.5 μg/m³, nitrogen dioxide 1-79 μg / m³ (exceeding the standards in Gorzów Wlkp.) carbon monoxide 332 - 1457 μg/m³, dust 27-131 μg/m³ (exceeding the norms of concentrations of medium-sized fine particulate dust in Gorzów Wlkp.), ozone (exceeding the norms in the entire province). Due to the investment in Gorzów Wielkopolski, planned dust reduction was to amount to 84%, SO₂ emissions - 24%, NOₓ - 29%, solid waste - 20% reduction, which in turn would result in the deletion of the heat and power plant from Gorzów Wielkopolski from the list of facilities harming the environment. In Zielona Góra, the plans assumed a decrease in the amount of SO₂ by 40%, dust - by 50%, the amount of furnace waste - a reduction of 50% [26, p. 32-44].

As recommended by COM(2003) 302 "Integrated Product Policy (IPP) using an environmental approach based on product life cycle analysis" [27], the staff of the University of Zielona Góra developed the LCA Report for EC Zielona Góra in 2014, which clearly shows the environmental benefits of switching from carbon to gas fuel. The LCA report was developed using SimaPro version 7.1 of the Dutch company PRe Consultans B.V. Eco-Indicator 99 has been used for environmental assessment, which has the advantage that it addresses the problem of decreasing raw material resources, which is very important in the impact study. As a functional unit, 1 MWh of electricity was
assumed. The final result of the LCA EC Zielona Góra (Figure 4) for the combined gas and steam generation scenario (GSB) versus the coal block (CB) was depicted for 3 categories of harm: Human Health, Ecosystem Quality and Resources, for which the results of the evaluation are expressed in the eco-indicator (Pt). Presented 1 Pt is the value of one thousandth annual environmental burden per capita of Europe [28, 29].

The aim of the analysis is to determine the environmental impact of electricity and heat as well as production from gas (whose average calorific value in 2008 was 28.42 MJ/Nm³) and hard coal (whose average calorific value in 2008 was 24.561 kJ/kg). The LCA analysis was divided into two phases: the first concerned the assessment of the environmental impact of electricity and heat as well as generation based on the previously mentioned fuels. The second phase took into account the need to transport this fuel to the Combined Heat and Power Plant. The data used in the study come from the years 2008-2012 and include elements entering the product system used in the production of electricity and heat as well as elements coming out of the production system, that is the amount of electricity and heat produced and pollution generated during production (air pollution generation, waste and sewage management). The analysis omits such aspects as: 1) environmental impact of the production of a gas-steam block with recovery boilers, steam turbines and their recycling phases after their exploitation, 2) environmental impact of the social facilities of employees of the Zielona Góra Heat and Power Plant, 3) generation of transmission networks and electricity losses [23, p. 36].

![Figure 4. LCA output of electricity production including transport of energy raw materials (for 3 categories of damage to GSB and CB) [23 p. 46].](image)

There is a clear outline of the differences between the years 2008-2011 of the operation of the coal block and the functioning of steam-gas blocks. The environmental benefit is on average 21.3 Pt, most visible in Human Health, then in Resources and Ecosystem Quality. There are no significant changes in the Resources category, as both hard coal and natural gas are non-renewable natural resources. According to EC Zielona Góra, the change to BPG has reduced emissions of sulfur, nitrogen, and airborne pollutants respectively: 90.6%, 81.8% and 97.2%, and carbon dioxide by 57.3%. This is a huge ecological success [24 p.46-47]. Comparing the ecological effect achieved with the one established in 2000, it can be clearly seen that this investment exceeded expectations. This is all the more important because in Lubuskie District there is a part of the Drawieński National Park, the National Park "Ujście Warty", seven landscape parks and other protected areas. The health condition of these areas and people living in these areas also depends on the quality of the air.
5. The summary

The construction of modern gas-steam units producing combined heat and power based on gas has significant ecological benefits. These benefits are not only related to the reduction of the environmental impact of dust (PM10) and gas emissions (SO\textsubscript{2}, NO\textsubscript{x}), the reduction of greenhouse gas emissions (CO\textsubscript{2}), but also indirectly affect human health and the quality of ecosystems.

The existence of EC Zielona Góra and EC Gorzów Wielkopolski, whose activity is based on gaseous fuel, favorably influences the process of adjusting the structure of consumption of primary energy carriers in Poland to EU requirements (its greater diversification - energy mix). The benefit of EC business is also based on the production of native gas deposits, although it is well known that there may be some risk (e.g. increase in variable costs). The minus is the high costs of the construction and the limitation of personnel costs, as these installations are automated and do not require a large number of employees, which is conducive to increasing unemployment (in January 2017 in the Zielona Góra unemployment was to 9.3%, in Gorzów Wielkopolski – 7.5% and 9% on average for the district) and is a very important factor influencing the development of both cities.

It is generally accepted that the policy of the two largest CHP plants in Lubuskie is coherent not only with the Polish Energy Policy by 2050 (PEP50) but also with other strategic documents concerning the development of the energy sector in Poland and the EU. However, there is a lack of large investments in RES in the region, although it has the potential to develop hydropower (estimated at 1544 GWh/year for the Central Oder and Nysa Łużycka), biomass and biogas production, good wind conditions and favorable sunshine. These two strengths of the district take advantage of the western neighbors - Germany. The weak side of the district is primarily a lack of financial resources and a poorly developed network of medium and high voltage lines, essential for power output.

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